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A Universal Measuring Machine

SPECIAL CORRESPONDENCE

This article describes the construction and the method of operation of a machine designed for the accurate measurement of pieces of all shapes. The machine is intended as a primary standard of measurement for use chiefly in making and checking gages. It has been made for some time in Switzerland, although it is a new machine to this country.

WHILE the system of interchangeable parts manufacture was first employed in connection with the making of rifles, rapid progress in the art of making mechanical measurements on a commercial scale began with the advent of the automobile. The production of cars on a large scale made interchangeability imperative in order to assure the perfect fitting of one part into or over another, especially in the matter of replacements and renewals. It is quite natural that the necessity of making great quantities of parts of the same form and dimensions should stimulate not only the production of gages for checking these parts in the shop, but also the development of the means of checking the working gages so that full control can be exercised over the sizing operations.

Gages that are in constant use for the checking of great quantities of parts show appreciable wear after being in service a short time. It is, therefore, of the utmost importance to keep a close watch on the condition of the working gages, and even on the inspection gages. The wear may be determined by suitable measuring apparatus or by means of reference blocks or reference gages. But reference gages themselves are subject to wear, although much more slowly, and it becomes necessary to check them against some sort of standard after more or less prolonged use.

Another serious difficulty experienced in testing laboratories is due to the great diversity in the form of the gages employed in shops. To check or verify the working gages it is necessary to make use of measuring appliances of various kinds, which appliances then become primary standards of reference. If these primary standards are of different make, to what extent will they agree among themselves, so as to assure proper checking of the gages or secondary standards? It is, therefore, seen that the matter of control of size is quite complex and may entail considerable expense, either as first cost or for maintenance.

Need of a Universal Machine

The problem of eliminating the various causes of uncertainty is by no means a simple one, the best theoretical solution being embodied in an instrument which will fill the following requirements:

1. The instrument must be of such a form or so designed that it will serve as the single primary standard for the control of all the secondary standards or gages that may be employed in the shops, no matter what their nature or form may be;
2. The precision of the instrument must be absolutely independent of wear.

Measuring machines that satisfy these conditions have a single graduated reference scale, which constitutes the primary standard. Instruments of this class are actually in use in the industries. They are made in the United States by the Pratt & Whitney Co., in England by the Newhall Engineering Co., and in Switzerland by the Société Genevoise d'Instruments de Physique. The machine made by the Société Genevoise

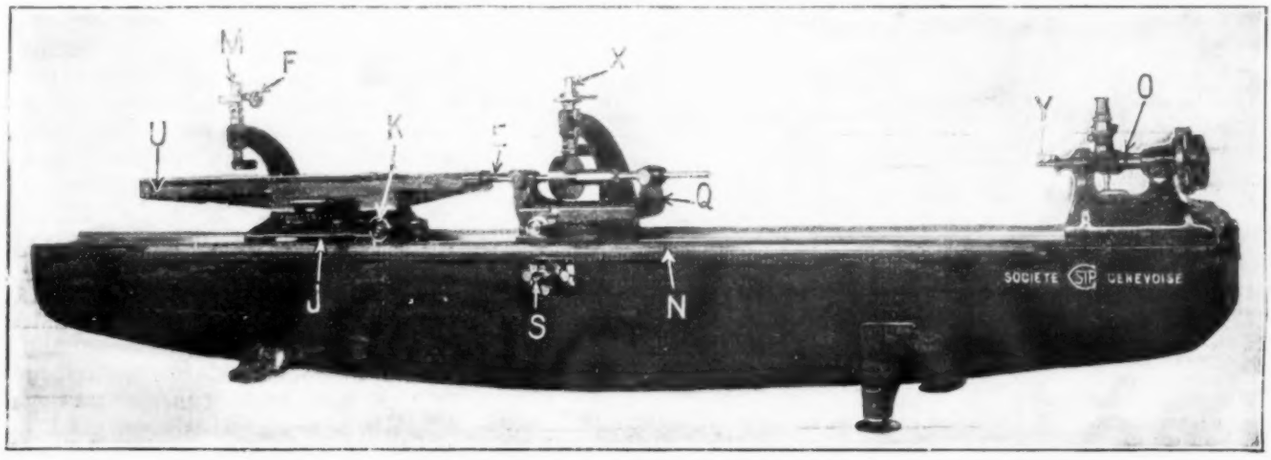


FIG. 1. GENERAL VIEW OF THE UNIVERSAL MEASURING MACHINE MADE BY THE SOCIETE GENEVOISE

will be here described, as it differs in principle from the other machines. The American representative of the maker is The Golden Co., 405 Lexington Ave., New York City.

This machine has been designated by its maker as a "universal" measuring machine, since it is designed with the object of measuring and comparing gages of every description, such as limit gages, plug, ring and snap gages, reference blocks, thread gages and screws. The measurement of threads includes the determination of the full or outside diameter, the diameter at the core or root of the thread, the pitch diameter, the angle and form of the thread, the lead, and either progressive or periodic error in the pitch. In addition, the machine may be used as a rapid comparator.

Measurements are made with reference to a standard scale, the accuracy of which has been certified. It is mounted on the machine in an inclosed case provided with sectional covers, and never comes in direct contact with the object or gage to be measured or with any of the accessories or attachments with which the machine is equipped. It is, therefore, not subject to wear or strains.

Construction of the Machine

Fig. 1 is a general view of the machine, together with one of the accessories in the form of a support used when observing and measuring threads and thread gages. A thread gage is shown mounted in position, with a goniometric microscope focused on the threads, this being in the center of the bed.

In Fig. 2 can be seen a longitudinal section, a transverse section and a top view of the machine, the model shown being shorter than the one in Fig. 1. The cast-iron bed of the machine is of strongly ribbed box construction. It is provided with ways on which rests the sliding carriage *U*. This carriage holds the standard reference scale *D*, as well as one of the measuring points or anvils *E*. Four spring-mounted rollers *A* serve to partly support the carriage and to reduce the friction on the ways. In order to displace the carriage quickly where a great traverse is desired, the locking device *C* is released by means of the handle *J*, and the carriage is pushed by hand. For small displacements or slow movements of the carriage, the motion is obtained, with the locking device engaged, by turning the handwheel *K*, which actuates through helical gears the screw *B* fitting in the block *L*. A complete turn of the wheel *K* gives an approximate displacement of 0.004 in., which enables the operator to adjust the position of the slider within 0.00001 in.

The bar *D*, on which the standard scale is ruled,

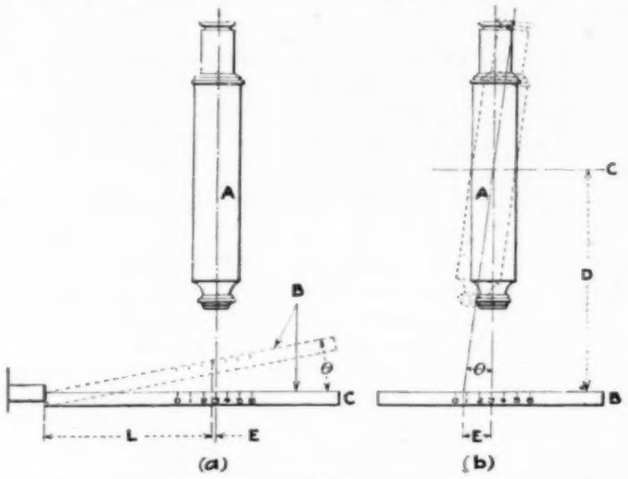


FIG. 3. ERRORS DUE TO NON-ALIGNMENT OF AXES

rests on the carriage at two points, one point *P* being a pivot, the other *G* being adjustable in a horizontal plane by two screws. The object of this arrangement is to provide for the setting of the scale parallel with the ways of the bed and in exact alignment with the axis of the measuring points. The bar is made of an alloy of steel and nickel, containing 58 per cent of the latter; the coefficient of linear expansion of the alloy is about 0.0000115 per degree Centigrade, approximately that of tempered steel. It is practically non-oxidizable and is not affected by the humidity of the air. The scale is ruled on a highly-polished side of the bar, the graduations being about 0.0002 in. wide and spaced 0.05 in. apart. The precision of the graduations over a length of 20 in. is 0.0001 to 0.0004 in. Tables of errors furnished with each machine enable the operator to make the necessary corrections and to make measurements to an accuracy of 0.000005 in.

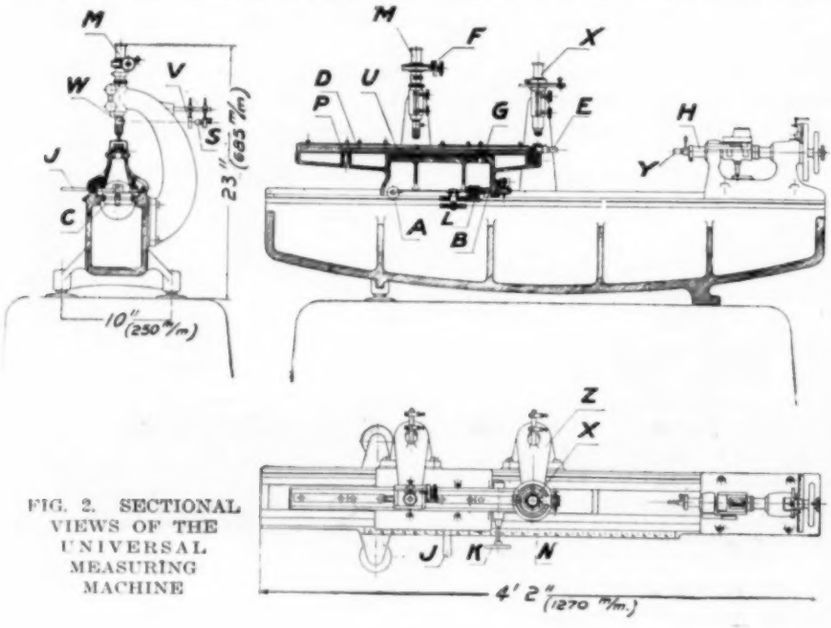


FIG. 2. SECTIONAL VIEWS OF THE UNIVERSAL MEASURING MACHINE

Fig.2

Principle of Operation

An important feature of the machine is the alignment of the axis of the scale with the axis of the measuring points, which reduces to a minimum errors of measurement due to possible accidental deviation between the axis of the scale and the axis of measurement. This is more readily seen on reference to Fig. 3 (a). *A* represents the fixed microscope, *B* the movable scale or reference standard, *C* the axis of measurement and θ the angle of deviation. This arrangement is the basis of the Société Genevoise machine. It is seen that $E = L(1 - \cos \theta)$, where *E* represents the error of the machine. It is pro-

portional to 1 — cos 0), which is a quantity of the second order and therefore negligible. In actual measurements it is claimed that E cannot exceed 0.00005 in.

In Fig. 3 (b), A represents a movable microscope, B a fixed scale (reference standard) and C the axis of measurement, which shows the principle on which some measuring machines are based. The error in this case

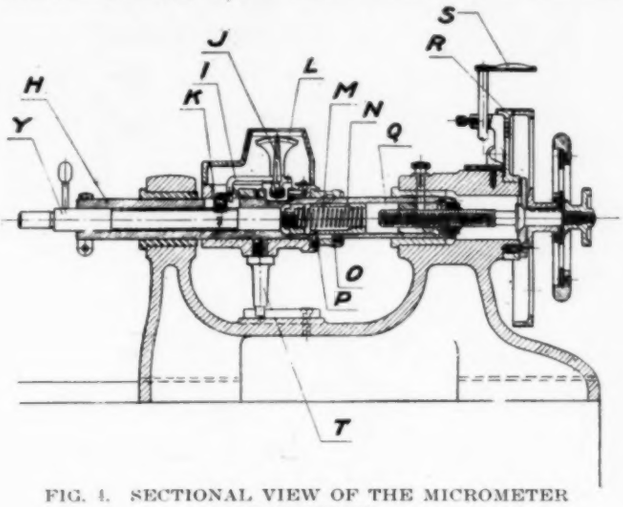


FIG. 4. SECTIONAL VIEW OF THE MICROMETER HEADSTOCK

is $E = D \tan 0$. This error is a magnitude of the first order and may amount to several ten-thousandths of an inch in actual practice.

THE HEADSTOCK

Fig. 4 is a longitudinal section of the micrometer headstock attached to the right-hand end of the bed. It is composed of a sleeve H containing a rod Y, the end of which forms the measuring point opposite to point E on the sliding carriage. On the sleeve H, which slides in hardened bearings, is attached a needle indicator composed of two multiplying levers I and J. The lever I is actuated directly by the hardened block K attached to the rod Y, and the multiplying ratio of the two levers is 1 to 1,000. The scale L is graduated in twentieths of an inch and has ten lines to the right and ten to the left of the zero point. A movement of the indicator J of one division on this scale corresponds to a movement of 0.00005 in. of the rod Y. The contact indicator, Fig. 1, differs somewhat from the one described, in that a microscope is employed for reading it.

The sleeve H contains a helical spring M fastened at one end to the rod Y, and at the other to the movable sleeve N. This sleeve, to which is attached the pin P, may be moved back and forth by means of the ring O. The ring has an internal helical groove which, as the ring is turned, causes the pin P and consequently the sleeve N to move parallel to the axis. The function of this arrangement is to put the spring M in either tension or compression by merely turning the ring O. In tension, the spring exerts a pull on the measuring point and puts the machine in condition for making internal measurements; with the spring in compression the apparatus is set for making external measurements. The same pressure is used when making all measurements, and when the indicator shows zero the pressure is about 0.5 lb.

Attached to the right-hand end of the sleeve H is a threaded piece into which fits the micrometric screw Q. The index wheel attached to the screw Q is graduated to read to 0.0001 in., and readings may be made to 0.00001 in. by means of the vernier R and the lens S. To prevent the sleeve H from turning, a pin T is attached to the housing of the indicator and slides between two hardened plates screwed to the headstock.

MAKING READINGS

When making readings the position of the reference scale is determined by means of a 60-power micrometric microscope M. On the scale N, Figs. 1 and 2, the integral number and fractional parts of inches as small as one-twentieth are read. In the field of the microscope, Fig. 5, can be seen a scale B graduated on glass, a fixed hairline C, two lines D traced on the standard scale parallel to the axis, two hairlines E, which may be moved by turning the graduated index wheel F, and the lines H which are the magnified graduations of the standard reference scale.

Readings with the microscope are made by turning the wheel F until the movable hairlines E are disposed symmetrically to the right and left of the image H of the graduation. Multiples of 0.005 in. are read in the microscope, and multiples of 0.00005 in. on the index wheel F. The field of the microscope is illuminated by a small electric lamp S, a condensing lens V and an illuminating prism W, Fig. 2.

In addition to the micrometric microscope for observing the graduations of the standard scale, the machine is also provided with a goniometric (angle measuring) microscope X, which is attached to the fixed arm Z and used for measuring the angles of screw threads. By means of a number of accessories measurements may be made on gages of every description, as well as on other parts. Referring to Fig. 6, it will be seen that without the use of any accessory, by simply setting the sliding carriage at any desired position, the machine may be used as a rapid comparator. When so used, readings are taken only on the indicator, shown in Fig. 4.

MEASUREMENT OF PLUGS AND PLUG GAGES

Where the plug to be measured is not over 4 in. in diameter, the fixture, Fig. 7, is employed. The plug is mounted between centers at right angles to the ways in a special support resting on four balls, which roll

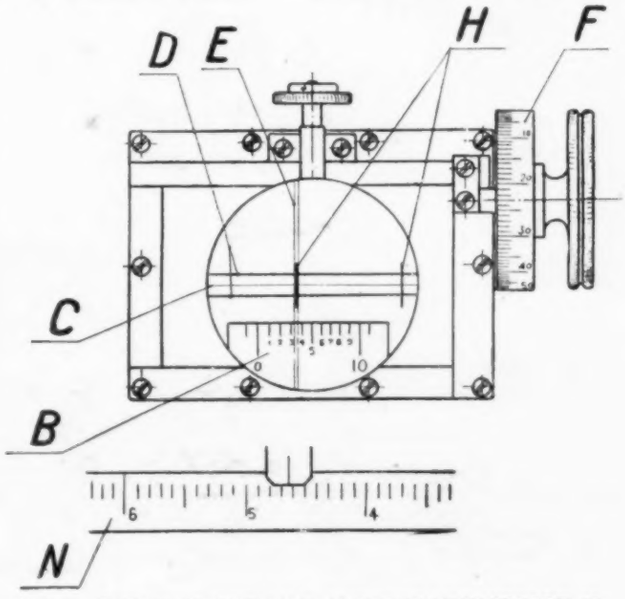


FIG. 5. FIELD OF THE MICROMETRIC MICROSCOPE M

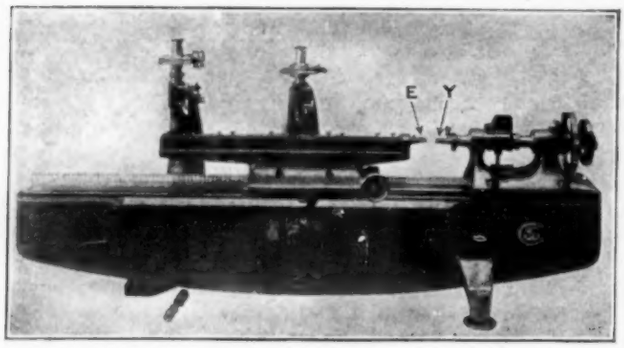


FIG. 6. THE MACHINE USED AS A RAPID COMPARATOR

freely in V-grooves parallel to the length of the bed. By revolving the plug it may be measured for eccentricity. The measuring point *E* of the sliding carriage is brought up to the plug and pressed against it; and, as the support moves freely on the balls, the plug in turn presses against the measuring point *Y* on the micrometer headstock. The indicator needle *J* is then adjusted to zero by means of the handwheel at the right and a reading is taken on the vernier *R*, Fig. 4. Plugs larger than 4 in. in diameter are placed on a support, see Fig. 8, and centered in the axis of the measuring points by means of the indicator.

For internal measurements, it is first necessary to turn the ring *O*, referring to Fig. 9, to the position marked *INT*, which sets the spring of the micrometer headstock to act in tension. The measuring points are fitted with special ends *J*, these being clamped in place by the locking rings *K*. The datum point for internal measurements is found or set by placing a standard 1¼-in. gap gage over the internal measuring faces, and adjusting the micrometer so that the contact indicator is at zero. The internal diameters of rings are measured in the same manner as in Fig. 9, except that the contact points used are spherical.

Measurement of Threads and Thread Gages

The outside diameter of a thread gage is measured in the same manner as the diameter of a plug gage.

When measuring the root or core diameter the screw or gage is mounted in the same way as for measuring the outside diameter. Triangular prisms *A* of hardened steel are suspended from the holder *B*, Fig. 10. The measuring points are brought up against the backs of the prisms, the sharp edges of which enter between the

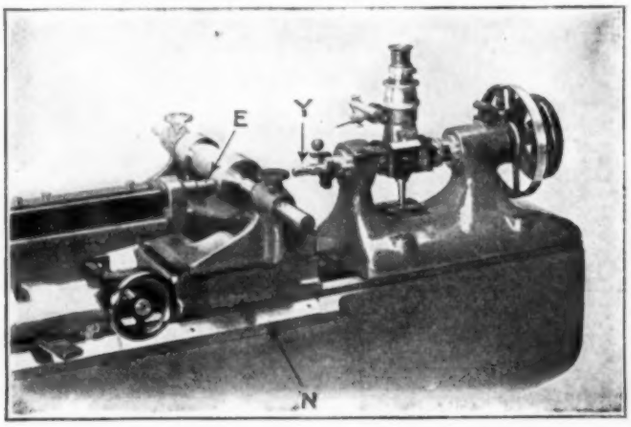


FIG. 8. ARRANGEMENT USED FOR MEASURING LARGE PLUGS

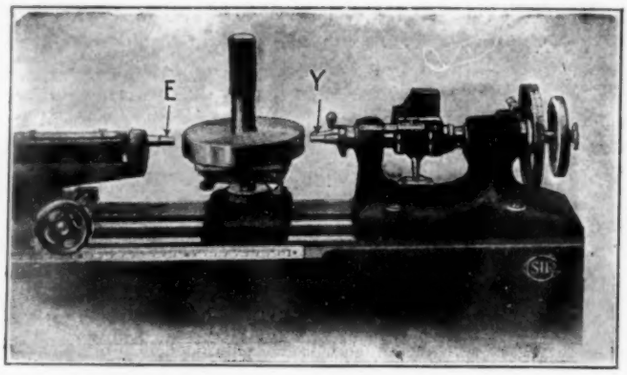


FIG. 7. ARRANGEMENT USED WHEN MEASURING SMALL PLUGS

threads and reach to the roots. The distance between the edges of the prisms is then found by substituting for the screw a plain plug of known diameter and taking a measurement.

There are two common methods used for measuring the pitch diameter, one optical, the other mechanical. Both methods can be performed with this machine. The mechanical method consists in placing small measuring wires in opposite spaces of the threads, their diameters being such that they project above the crests of the threads. The arrangement is the same as that shown in Fig. 10, wires being substituted for the prisms at *A*. The diameter over the wires is measured; and the pitch diameter can be calculated by the following formula, the meaning of the symbols being shown by Fig. 11:

$$\text{Pitch diameter} = E - 2d + \tfrac{1}{2} P \cot\frac{\theta}{2} - d\left(\frac{1}{\sin\frac{\theta}{2}}\right) - 1$$

Measurements may be made to an accuracy of 0.00004 in. The mechanical method should be employed whenever possible, although the accuracy of the measurement depends to a great extent on the uniformity of the diameter of the wires and the accuracy of their measurement. The optical method, on the other hand, requires a trained eye to obtain good results.

The Optical Method

The optical method of measuring pitch diameter consists in setting the hairline of the goniometric microscope *X* successively on the two opposite flanks *N* and *O* of the thread, Fig. 12, by moving the screw transversely across the field of the microscope. The distance traversed *e* is the pitch diameter.

A perspective view of the fixture employed for this

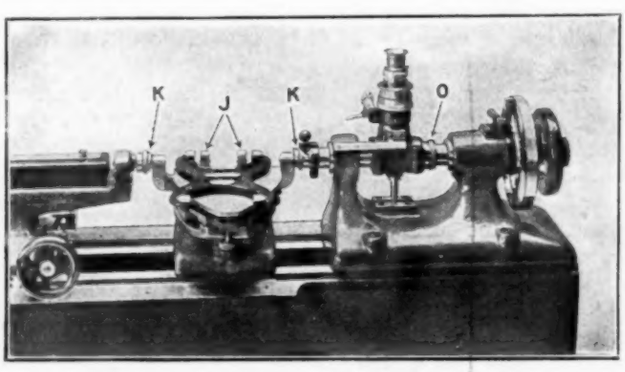


FIG. 9. ARRANGEMENT USED FOR INTERNAL MEASUREMENT

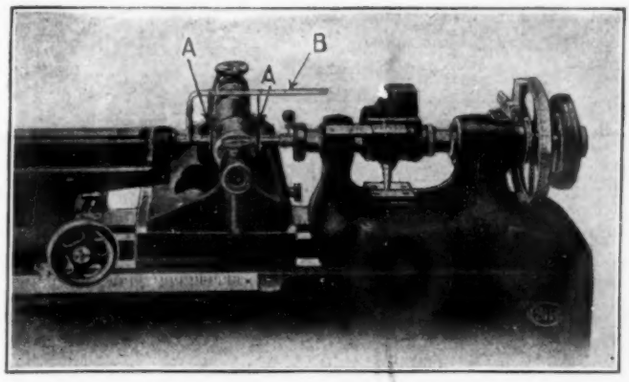


FIG. 10. MEASURING THE ROOT DIAMETER OF A THREAD

purpose is shown in Fig. 13, and it will be seen that the fixture is connected to the measuring anvil of the sliding carriage by the spring coupling *F*. Part *D* of this accessory slides on the bed, and the upper side of it is provided with V-grooves parallel to the ways. A set of four balls in these grooves permits the part *E* to move freely in a direction parallel to the length of the bed with any movement of the sliding carriage *U*. Another set of four balls resting in V-grooves in *E* gives freedom of motion to *Q*, in a direction perpendicular to the length of the bed. With the adjusting screw *G* the screw or gage to be measured may be brought into the axis of the microscope *X*. This arrangement is used for measuring pitches and thread angles of screws or thread gages up to 4 in. in diameter.

The field of the microscope is illuminated from below by a parallel beam of light which passes through an adjustable collimator *S*, capable of being both moved longitudinally and inclined so that the beam of light is parallel to the slope or inclination of the thread to the axis of the screw being measured. A scale *T* with an index and vernier controls the adjustment of the beam of light and permits reading to 10 min. of arc.

The circle *B* mounted on the center point is graduated in degrees. The scale *C* of the goniometric microscope *X* is graduated in half degrees and a vernier gives minutes of arc.

To measure the angle of a thread the movable hairline of the microscope *X* is set parallel, first, with the axis of the screw, then with the apparent right-hand flank of the profile, and last with the left-hand flank. The field appears as in Fig. 14. Care must be taken by the operator to observe the contour of the thread formed by a horizontal section through the axis of the screw and not the shadow of the profile outside of this plane.

Determination of the Pitch

To measure the pitch, the same fixture, shown in Fig. 13, is used, the hairline of the microscope *X* is set over the flank of one of the threads of the screw and a reading is taken with the micrometric microscope *M*, which has been set on a line of the reference scale. The sliding carriage *U* and the fixture holding the screw are then moved, and the number of threads passing under the field of the microscope *X* is noted. The hairline of the microscope is set over the flank of the thread under it and a reading is again taken on the reference scale. Of course, the pitch is equal to the

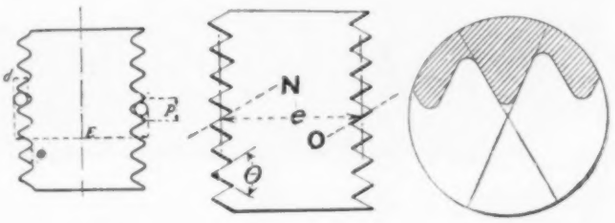


Fig. 11. Fig. 12. Fig. 14.

FIGS. 11, 12 AND 14. DETERMINING PITCH DIAMETERS AND MEASURING THREAD ANGLE

Fig. 11—Mechanical method of determining the pitch diameter. Fig. 12—Optical method of determining the pitch diameter. Fig. 14—Field or goniometric microscope when measuring angle of thread.

difference between the readings divided by the number of threads passed over. This method is very accurate.

For measuring progressive or periodic error the same procedure is followed, but the screw is moved a partial turn on its centers. By means of the graduated circle *B* the extent of the turn may be accurately determined.

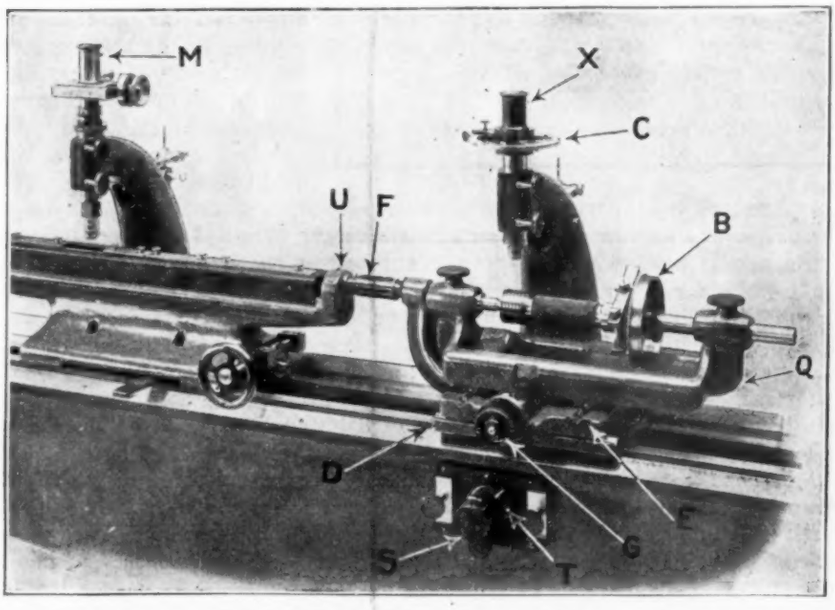
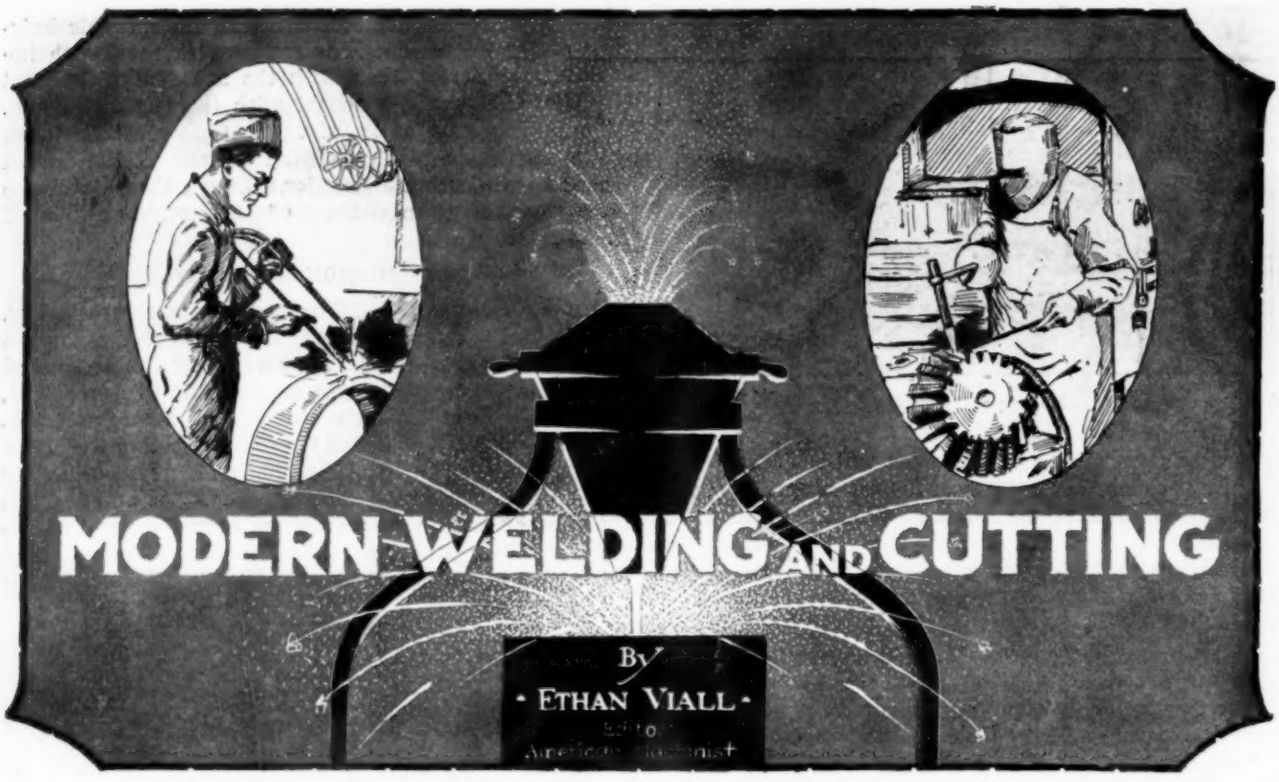


FIG. 13. FIXTURE USED FOR OPTICAL MEASUREMENT OF SCREW THREADS

For the optical measurement of the three principal diameters of a screw (outside, pitch and root) the support *Q*, Fig. 13, which carries the centering points, is removed. A similar support is used, which is provided with a special micrometer transverse screw with 20 threads to the inch and an index wheel equipped with a vernier so as to read to 0.0001 in. A small support carrying the work between centers is displaced by means of this micrometric screw, whose axis passes through the plane of the centers. This support is pressed against the screw by a spring, and rolls on three balls resting in V-grooves. Measurements are made with the microscope *X*, the hairlines being set parallel to the axis of the screw when the outside and core diameters are being measured, and parallel to one flank of the thread when the pitch diameter is measured.



WHERE close cutting to a line or pattern with a gas torch is desired, some mechanical device must be provided for guiding the torch. A properly constructed machine saves time, material and gas.

The more common mechanical devices in use are for feeding the torch in a straight line. These are used to cut bars, billets, boiler plate, armor plate and the like. An Oxweld straight-line cutting machine is shown in Fig. 275. An ordinary cutting torch is used in this case, and the end of a 12 x 12-in. billet has just been cut off. The feed screw may be turned from either end by means of hand-wheels, and means are provided for cross adjustment.

Another device, made by the Davis-Bournonville Co., is shown in Fig. 276. The pieces, which were cut the long way, measured 15 x 13½ in. This machine has a handwheel on one end of the feed screw and a cone pulley, for power drive, on the other. Unlike the device first shown this one is not mounted on legs but has a short section of I-beam for a base. On this account it may be placed on the object to be cut or laid on blocks or horses, as occasion demands.

The device shown in Fig. 277 differs from either of the foregoing in that racks are used in place of lead screws. This is made by the Great Western Cutting and Welding Co., San Francisco, Cal. The heavy structural iron base is so made that it may be placed on the work, laid on blocks or horses or mounted on legs. Means are provided for adjusting the torch up or down or at an angle.

XXIII. Cutting Machines*

Cutting machines using a gas torch do not offer the difficulties of operation inherent in those for welding. As a consequence, cutting machines are more commonly built and used. The machines shown in this article cover the principle types and makes.

(Part XXII appeared in our June 2½ issue.)

Any of these machines may be used for cutting out marked square, rectangular, round or irregular shaped holes. Where the metal is thick, it is often better, especially on repetition work, to drill a hole through for starting.

The Radiagraph

The Radiagraph shown in Fig. 278 is made by the Davis-Bournonville Co. It is a motor-driven device, with oxy-acetylene or oxy-hydrogen cutting torch, adapted to cutting along straight lines or circles in steel plate from ¼ in. to 18 or 20 in. in thickness, the speeds varying from 2 in. to 18 in. per minute, according to the thickness of the plate. For straight line cutting, it operates upon a parallel track, and for circle cutting, with a rod and adjustable center. The device consists principally of a three-wheeled carriage driven by an electric motor attached to the carriage, which may be connected to the ordinary lighting or power circuit, either d.c. or a.c., 110- or 200-volt circuit. An adjustable arm and torch holder provides for raising or lowering the torch while in operation, and for adjustment at an angle for bevel cutting. The adjustable arm also permits of following an irregular line within a variation of 3 in. on either side of a straight line. The cutting torch is connected by hose to the gas supply. The machine is portable, weighing approximately 50 lb. complete, and has proven an invaluable aid in steel cutting, greatly facilitating such work in shipyards and steel mills, several machines being employed advantageously in some of the larger plants.

An example of some of the straight line cutting done

*For the author's forthcoming book, "Welding and Cutting."
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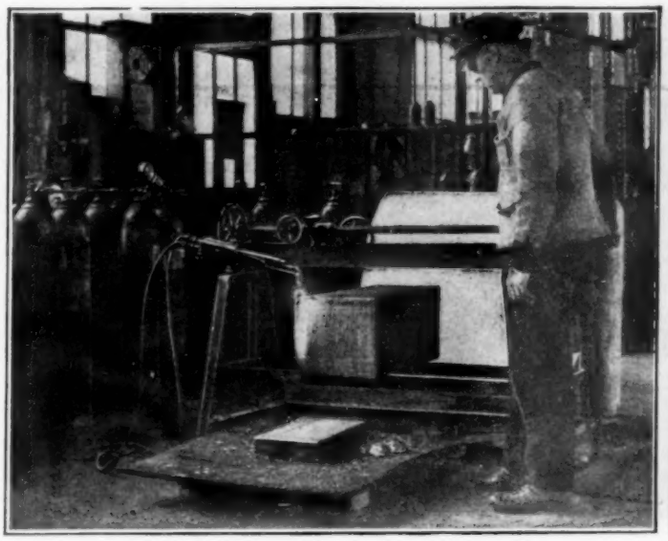


FIG. 275. CUTTING A BILLET WITH AN OXWELD MACHINE

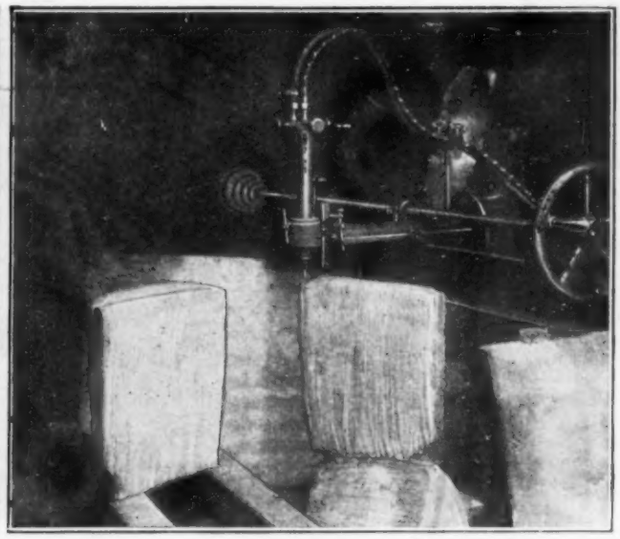


FIG. 276. ANOTHER STRAIGHT-LINE CUTTING MACHINE

by the Radiagraph is shown in Fig. 279. Here the track has been laid on a heavy piece of ship plate and the torch is fed along at a uniform rate by the motor.

THE RAILOGRAPH

For cutting railway rails the device shown in Fig. 280 is used. This is clamped to the rail while it is in position on the roadbed if desired. The cutting torch may be mounted in a holder on either side of the rail. Each holder is carried by a slide. Attached to each holder is a roller which runs in contact with a cam formed in such a way that it provides for maintaining the tip of the cutting torch at a uniform distance of about ¼ in. from the surface of the work as the torch is fed around the rail. Feeding of the torches is accomplished by two handwheels which transmit motion through a set of suitable gearing. In operation the torch is first applied at one side of the rail and fed over the line on which the cut is to be made, one-half of the base and head of the rail and the web being cut in this way. The torch is next removed from the holder and mounted at the opposite side of the rail, where it is again passed over the line of cut, with the result that the remaining half of the base and head of the rail is severed. A 9-in. traction rail can be cut off in about three minutes.

The cutting of heavy steel plate in the great Schneider Works, Creusot, France, is shown in Fig. 281. The portable devices are very similar to those used in the United States. In the background is a huge machine so made that it can be used to trim ends, square up a plate and cut angles or circles. The torch carriage is fed along by a lead screw run by a motor seen at the extreme right. A motor-operated device will raise or lower the frame or give it a circular movement. The plates to be cut are run into position on small flat cars.

CIRCULAR CUTTING

The Radiagraph cutting circles, is shown in Fig. 282. The work was 2½ in. thick and was cut at the rate of

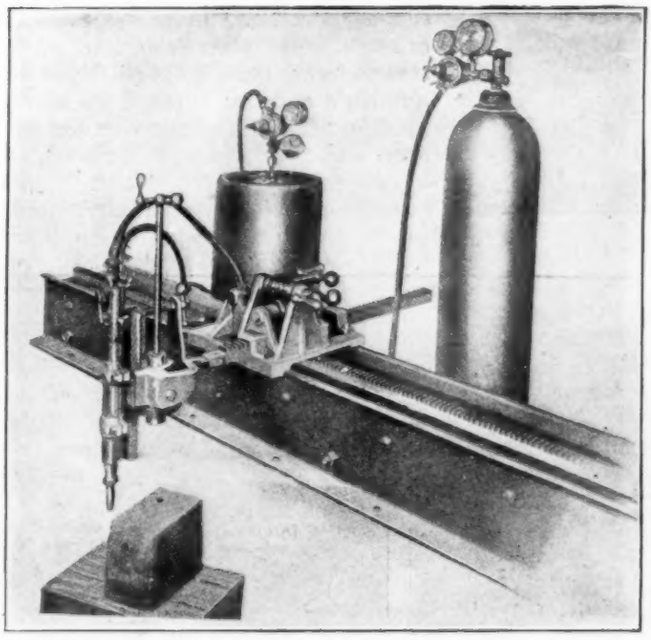


FIG. 277. PORTABLE CUTTING MACHINE WITH RACK FEEDS

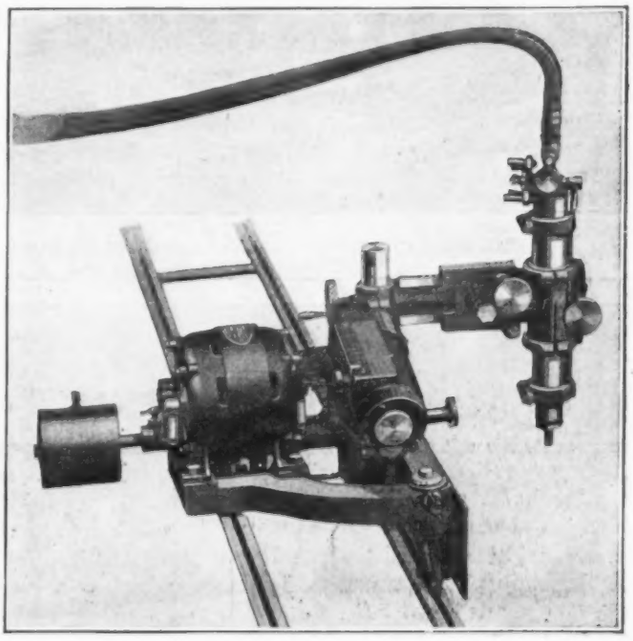


FIG. 278. DAVIS-BOURNONVILLE RADIAGRAPH

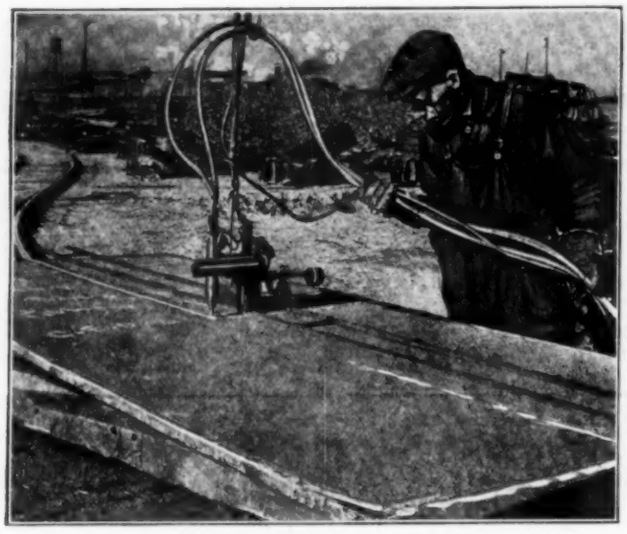


FIG. 279. RADIAGRAPH CUTTING STEEL PLATE AT THE NEW YORK SHIPBUILDING YARDS

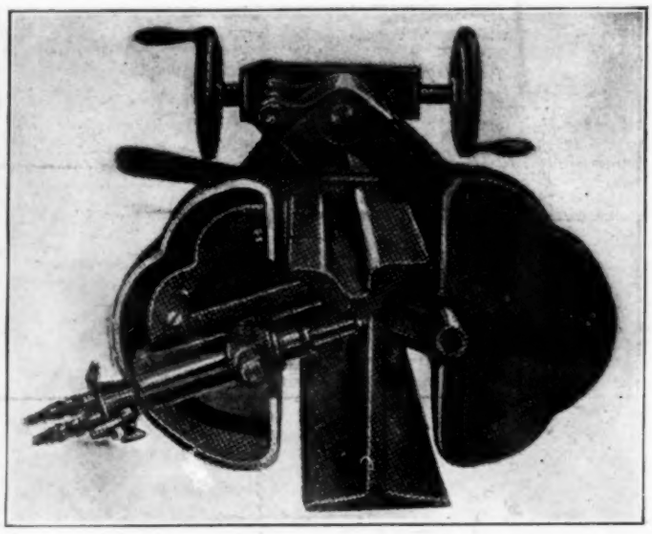


FIG. 280. DAVIS-BOURNONVILLE RAILOGRAPH

6 in. per minute. Note the true circle and surface of the cut. The pieces were for a special type of heater for the Government. The round piece, or flue sheet, is 30 in. in diameter and the ring, or flange, 45 in. outside diameter.

Another device is the Holograph, shown in Fig. 283. It is a device for cutting holes in the web of a rail, or in structural iron, of not more than ¾ in. thick. It is quickly attached and accurately adjusted. It pierces through the iron almost instantly, without any previous drilling, and will cut smooth round holes from 1 to 2 in. in diameter in from 30 to 60 sec. It is particularly adapted for railroad work, and enlarging or cutting holes in building and bridge work.

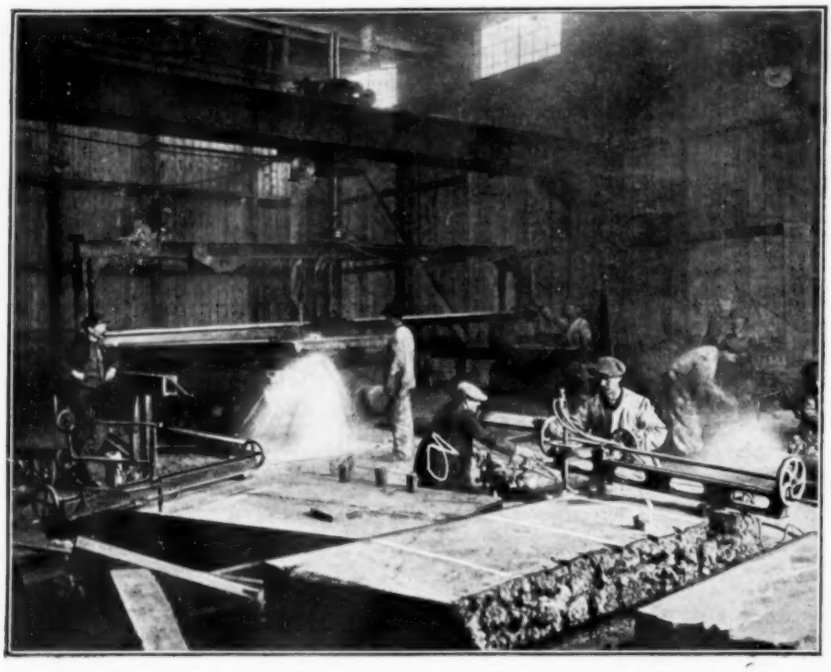


FIG. 281. CUTTING HEAVY PLATE AT THE SCHNEIDER WORKS, CREUSOT, FRANCE

THE MAGNETOGRAPH

The Magnetograph shown in Fig. 284 was designed for mechanically cutting circles up to 12 in. diameter in steel plate in perpendicular position, such as cutting port holes in the side plates of ships. Steel plate from ¼ in. up to several inches thick is cut quickly, with a finished and true surface, the movement of the oxy-acetylene or oxy-hydrogen torch and flame being given by handwheel and gears. Cutting is accomplished at varying speeds according to thickness of plate, from 3 in. up to 20 in. per minute, or even faster on

FIG. 282. RADIAGRAPH USED FOR CIRCULAR WORK

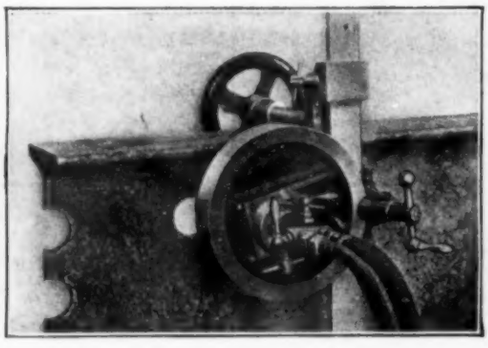


FIG. 283. DAVIS-BOURNONVILLE HOLOGRAPH

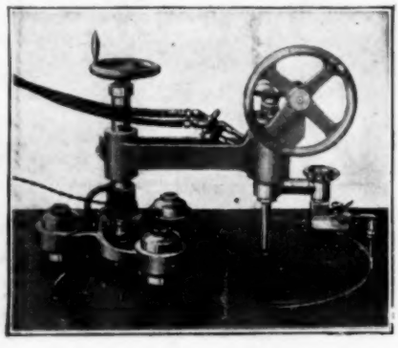


FIG. 284. DAVIS-BOURNONVILLE MAGNETOGRAPH

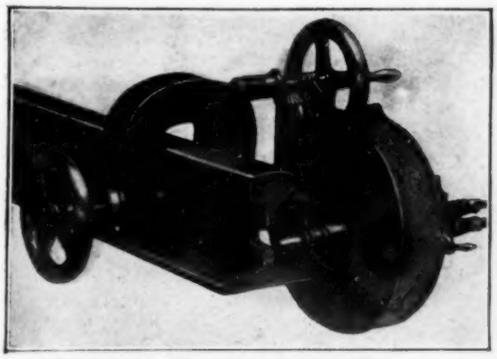


FIG. 285. THE CAMOGRAPH

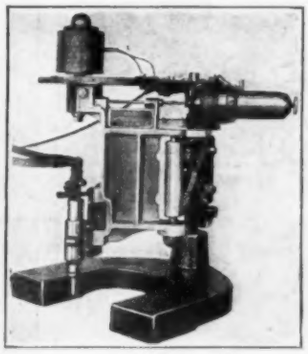


FIG. 286. CAMOGRAPH NO. 2

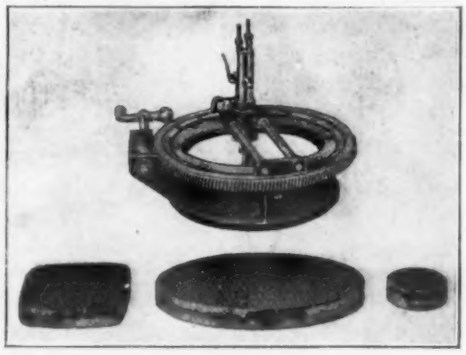


FIG. 287. GREAT WESTERN CUTTER

light plate. The device is constructed as much as practical of aluminum to obtain lightness, and is held firmly on the plate by means of three electromagnets, connected by wire to an electric circuit (direct current) or to battery.

The Camograph

The Camograph, Fig. 285, is an adaptation of the Holograph. It is of the same general construction, except that it is larger and has a wider range of work. It is fitted with a cam for each particular kind of work, and will cut almost any form desired, within the capacity of the machine. This machine requires special cams for each operation.

The Camograph No. 2, shown in Fig. 286, is a later development of the Davis-Bournonville Co. It is automatic in operation and is used for cutting openings in steel plates that cannot be done conveniently or economically on a drilling machine. The torch is mechanically traversed over a fixed path and at a predetermined speed. The path followed is controlled by an internal cam at the top of the machine, the shape of which determines the shape of the opening being made, the double-jointed radial arm permitting universal movement of the flame which perforates the steel. The principle of the cam guiding action is unique. The feed roller is magnetized by a powerful electromagnet, and is thus attracted to the inner face of the cam, the parts in contact being made poles of the magnet, one of which rotates and thus acts as a traction driver. The roller is driven by a small variable-speed motor through double worm gearing, the magnetic attraction being sufficient to cause it to travel along the face of the cam in a positive manner. Direct current is required owing to the magnetic feature, and the control consists of a double push-button switch for starting, stopping and also for energizing the magnet. Arrangement is provided whereby when the cutting oxygen is turned on the feed motion automatically starts. The nominal diameter of the largest hole cut is 7 in., but openings other than circular, having one dimension much larger, may be provided for. All thicknesses of plate used on the largest marine boilers are readily cut with this machine. The machine is 17 in. wide, 15 in. deep, 25 in. high, weighs 125 lb., and uses 110 volt, direct current.

The Great Western Cutter

The machine shown in Fig. 287 is made by the Great Western Cutting and Welding Co. It is designed to cut round, square or oval holes. Three master plates are furnished for holes of these shapes. By turning the handle the torch travels around the inside of the form, to which it is held by the two coiled springs shown. The machine is simple and light. Extensions are furnished for cutting large holes. For odd-shaped holes extra plates are required. This machine is especially adapted for boiler shops, shipyards, etc., in cutting hand holes, manholes, fire-box door holes, and holes in tube sheets.

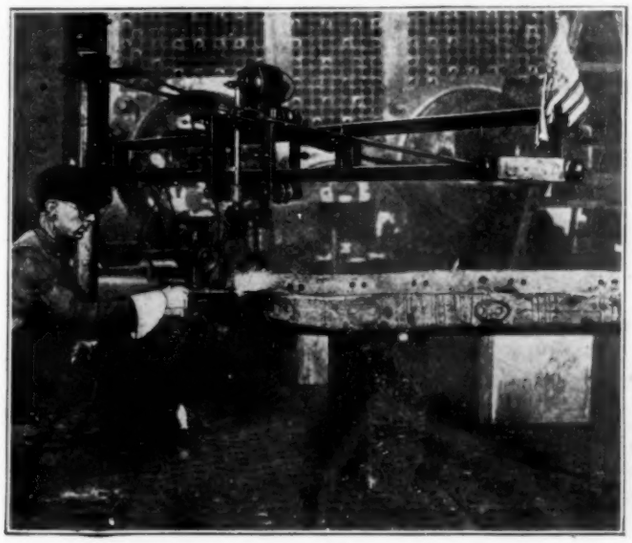


FIG. 288. PYROGRAPH TRIMMING AND BEVELING BOILER FLANGES

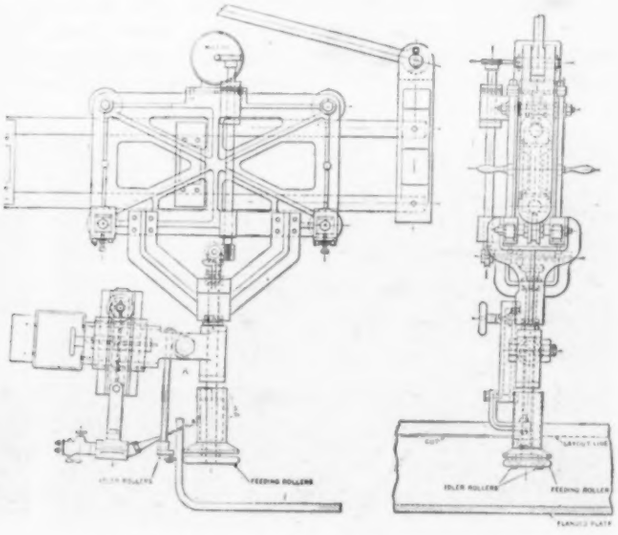


FIG. 289 DETAILS OF PYROGRAPH FEED MECHANISM

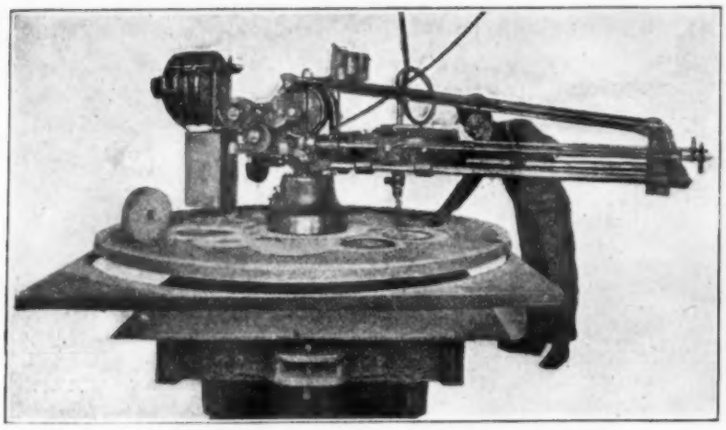


FIG. 290. AUTOMATIC UNIVERSAL CUTTING MACHINE

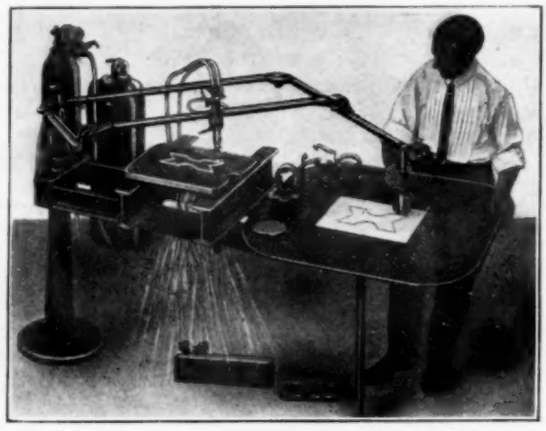


FIG. 291. SINGLE-TORCH OXYGRAPH

The machine shown in Fig. 288 is known as the Pyrograph and is made by the Davis-Bournonville Co. The model shown is not the latest, but well illustrates the general principles of the more improved ones. It was designed primarily for boiler-shop use in turning flanged boiler heads or cutting openings for doors, manholes and the like. In one shipyard boiler plant, flanged combustion chamber heads, $\frac{3}{4}$ in. thick with a flange periphery of 27 ft., were trimmed and beveled to the calking angle in 30 min., exclusive of the setting up.

As can be seen, the Pyrograph comprises a motor-driven carriage supported on a radial arm of a length that provides for cutting the flange of a 9-ft. diameter boiler head at one setting. While the largest diameter circle that can be cut at one setting is 9 ft., much larger work may be trimmed and beveled, inasmuch as the arm can be swung through a semi-circle of 20 ft. or a full circle of 20 ft. diameter, provided the shop conditions permit the arm to swing in a complete circle. Heads larger than 9 ft. diameter are reset as many times as may be found necessary to reach the flange all around.

The radial arm construction is light but rigid, consisting of two cold-rolled parallel round steel bars firmly tied together by end connections and intermediate spacer blocks, and supported by a truss rod. The vertical cast-iron pivot member of the radial arm is mounted on ball bearings at the top and bottom, in order to insure the maximum ease of movement. The steel post around which the radial arm swings is adjustable vertically by means of a crank operating a rack-and-pinion gear. A dog and rachet hold the post at any height within the limits of adjustment required.

The column has a broad flanged base which may be bolted to a cast-iron floor plate or a concrete foundation if required to be self-supporting, or the top of the post may be shackled to a column of the shop building and the base supported on an ordinary floor without an individual foundation.

The carriage is supported on the radial arm by four grooved ball bearing rollers which provide for the easy radial movement required to follow the feed action freely. The carriage and the arm derive their movements from the feeding mechanism which operates directly on the part to be beveled, the flange part itself acting as the track and guide for the feeding mechanism, as shown in Fig. 289.

The torch is adjustably mounted on the carriage beneath the radial arm, and the tip may be directed at any angle required to cut to the desired calking angle.

The flange to be trimmed and beveled is gripped between the three feeding rollers, two of which are small idlers on the side next to the torch while the driving roller, considerably larger, is located on the far side of the flange. The driving feed roller derives its motion from a small electric motor mounted on top of the carriage and driving through a reducing train of worm and bevel gears. Variations of speed are provided by making the upper worm and worm gear replaceable with worm gears of different ratios. The following speeds are available: 12 in. in 70 sec., 12 in. in 90 sec. and 11 in. in 60 sec.

The pressure on the feed rollers required to produce

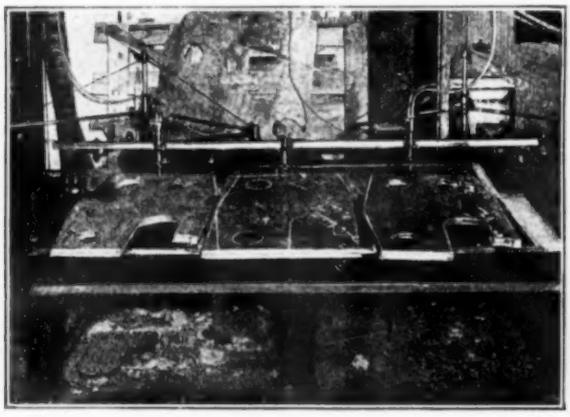


FIG. 292. OXYGRAPH WITH TWO TORCHES

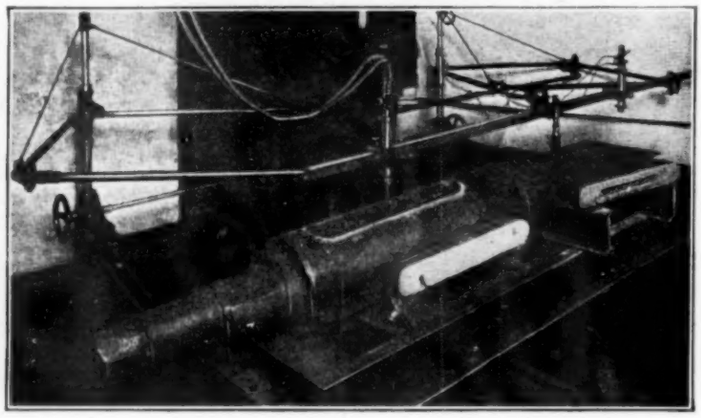


FIG. 293. CUTTING OUT A LARGE SLOT

the traction necessary to traverse the torch and carriage is obtained from the weight of the torch, the slide rests on which it is carried and the frame to which the two idler feed rollers are attached. The frame carrying the slide rests and idler feed rollers is pivoted, and the weight forces the idler feed rollers against the side opposite the driving roller with sufficient pressure to traverse the carriage positively. The feed mechanism operates on any shape whether straight or curved, thick or thin. Flanged sheets are generally rough, presenting a more or less irregular contour, but this does not interfere with the carriage traverse and the torch action. The operator may interrupt the feed at any point by raising the frame, thus relieving the pressure on the feed roller.

The driving roller and its shaft are protected by a shield of fireproof composition having a beveled flange at the bottom, on which the sparks and slag have no effect. The machine, once set, trims a flanged sheet evenly all around, provided the sheet has been properly leveled. Otherwise it is necessary to chalk a line to be followed.

In the plant of the New York Shipbuilding Corporation, three different combustible gases are used in cutting torches, namely, carbo-hydrogen, acetylene, and hydrogen. The combustible gas selected for different classes of work depends upon the thickness of the plates which have to be cut. The range of thickness handled by the different gases is as follows: Up to 3 in., carbo-hydrogen; 3 in. to 6 in., acetylene; and over 6 in., hydrogen. It will, of course, be understood that either of these gases is mixed with oxygen.

A Universal Cutter

A machine built somewhat along the lines of the Pyrograph, but a much more universal machine, has been developed for use in the shops of the General Electric Co., Schenectady, N. Y. This machine is shown in Fig. 290. It can be set for automatically making circular, spiral, radial or tangential cuts. Its rate of feed can be varied from 1 to 72 in. per minute, according to the character and thickness of the metal. The base of the machine is provided with a powerful electromagnet to be used if the machine is placed on a rough or uneven surface and also to hold it in position when it is necessary to perform cutting operations on work held in a vertical plane. Ordinarily, the weight of the machine is sufficient to hold it steady. As shown, the machine is mounted on a truck for easy transportation, as it weighs 1,900 lb.

The Oxygraph

With the Oxygraph, steel plate from 1 in. to 15 in. or more in thickness is cleanly cut with a narrow, smooth kerf, along straight lines, sharp angles, or curves, according to drawing or pattern. The pantagraph principle is employed, with a motor-propelled tracing wheel, with which the lines of the drawing are followed and reproduced with the cutting torch. Either the oxy-acetylene or the oxy-hydrogen cutting flame is used, with hose connection to the source of gas supply. The only power required is for revolving the tracing wheel, and this is supplied by a small motor attached to the tracing head, which may be connected to the ordinary electric light or power circuit. A universal motor, either d.c. or a.c., 110- or 220-volt circuit, with rheostat and friction governor is used. The speed of cutting varies from 2 to 18 in. per minute, according to the thickness of steel being cut.

One size of machine is applicable to small work and die cutting, within a cutting area of 16 in. square, a circle of 18 in., or a rectangular form 12 x 40 in. may be cut by extension of the tracing table. With this machine, a drawing or pattern double the size of the cut to be made is required, the drawing being placed on the tracing table shown at the right in Fig. 291.

Another machine is made for larger, heavier work. It has a double pantagraph frame and is fitted with two cutting torches for making duplicate cuts at the same time, the position of the torches and tracing wheel being adjustable. The entire pantagraph frame may be moved backward from the table to allow placing of heavy plate with a shop crane. This machine reproduces the cut of equal size with the pattern, or 1 to 1.

A machine with two pieces of work and pattern in place is shown in Fig. 292.

Another practical application of the Oxygraph is shown in Fig. 293. The piece worked on is a fishing tool used for fishing out broken tubes in oil wells. This Oxygraph has a bed frame 30 in. wide by 9 ft. long. The fishing tool is hollow, with walls 2½ in. thick, and weighs 900 lb. The total cut made of 21 lin.ft. was made in 21 min. or 1 ft. per minute.

Meters or Feet?

By F. D. Hood, *Polytechnic High School.*
Los Angeles *School Journal*

There is a movement on foot just now to make compulsory the use of the metric system in the United States. This means, of course, the retirement of the foot and its replacement by the meter, whether we like it or not.

The scheme seems to be engineered by the World Trade Club of San Francisco, whoever they are. Few people seem to know anything about the scheme, and maybe this is part of the plan until sufficient deadly work has been accomplished at Washington to insure its success.

One thing is certain in the minds of those who are in close touch with industry, and this is the field where the movement will have its most appalling results, and that means there will be industrial paralysis to begin with and eternal confusion thereafter, for the simple reason that the old units refuse to be displaced wherever it has been attempted, even in the country of metric origin, and we shall therefore have two systems of weights and measures instead of one.

Viewed from a pretty wide angle, the two countries using the English system of weights and measures as their legal standard, namely, the United States and Great Britain, have grown industrially and financially fat, much more so in the case of former than in any country where the use of metric system is enforced by the policeman's club. So the English system cannot be such an awful drag, as some are apt to think.

Surely these pro-metric advocates do not comprehend what this change means, either in money or goods, or they would not at this time urge its compulsory adoption. Hundreds of millions of dollars worth of gages and standards in the manufacturing industries alone will have to be scrapped and as many new ones made. Every automobile sign in the country indicating speed will have to be changed to read centimeters per second.

because every new speedometer will be in the same system. Owners of old ones can keep a set of conversion-tables handy. Every new length of pipe will be in metric threads; connection with English threads can be made with hose, perhaps, or pay toll in the shape of a transition-fitting. And so on *ad libitum*.

Surely the industries are sorely enough harassed as it is, without inflicting this upon them; production is years behind, as it is. If the arch-propagandist of Berlin had set his diabolical brains to scheming up something to set this country back industrially about ten years he could not have produced a more all-around effective plan than to make the metric system compulsory here and now.

And what is it all for? Nothing, but uniformity—deadly uniformity. Things will not be made any more rapidly, any better, any cheaper, nor in greater quantities than with the English system. No one has any quarrel with our present system of weights and measures, at least they keep quiet about it if they have, except those who do not use it anyhow, and they are in the minority, by far.

The case for the metric system would be stronger if it really had accomplished uniformity where it has been tried and made a clean sweep, though nothing is said about the twenty-four hours of the day, sixty minutes, sixty seconds and the three hundred and sixty degrees of the circle (nothing metric here), but if the kind of uniformity that the compulsory use of the metric system would bring to this country is the same kind of uniformity that its obligatory use has brought to France (to say nothing of the hodge-podge in other so-called metric countries) with her maze of yards, metres, aunes, kilograms, pouces, sous, moques, deniers, and Paris pounds—then Heaven forfend. We indeed have a uniform system in comparison.

Talking about making the thing compulsory, why, the Government would have the biggest job on its hands that it ever tackled if it tried to stop the American people from using the system if they wanted it. They do not want it, except just where it is, that is why it is where it is.

Casting Losses in Aluminum Foundry Practice in U. S.*

By Robert J. Anderson

Casting losses are a serious source of financial loss in iron and steel foundry practice, as well as in brass and bronze, but they are particularly serious in aluminum foundry work because of the high value of the aluminum. If a foundryman will study his daily production of defective and wasted castings, he will be able to trace the cause for losses and then make such corrections in his plant practice as will effect a considerable reduction in these losses—as much as 50 per cent in some. If all the present casting losses of the United States could be reduced 50 per cent by eliminating only the readily preventable defectives, a saving of several million dollars would accrue. In the aluminum foundry industry alone, the saving would amount to $600,000.

Light aluminum alloy sand castings may be rejected for defects resulting from one or a combination of causes, including cracks, sand holes, chill blows, and core blows, cold shuts, hard spots, porosity, leaks, and general unsoundness; uneven walls and core shifts, hard and soft ramming, breakage on trucking, handling, chipping and cleaning; cracking on welding, cope drop, short pour, dirty and broken cores, and sand or paste in the cores; run out, molds crushed in core setting, gates washed in, poor patching, wet sands, draws and shrinkage warping; broken molds and inferior metal. On account of the large number of variables in foundry practice, it is at times difficult to trace the exact causes for specific defects. However, the factors that will most likely cause defects in the castings can be classified; then it will be easier to trace the defects to a definite cause or combination of causes. By eliminating the causes, the defects will disappear. Admittedly, this is not always easy to do, but the first step to be made in attempting to reduce casting losses is a thorough diagnosis of the causes for defects.

A recent survey of the aluminum foundry industry by the Bureau of Mines has made data available regarding the losses sustained in the United States in the production of all kinds of commercial light aluminum-alloy castings. The average casting loss, including rejections of all kinds on the foundry floor, in the inspection department, and machine-shop returns, may be placed conservatively at 10 per cent. Variations in losses, as reported to the Bureau by numerous foundries, range from 0 to 75 per cent; no variation of losses is rare except for certain types of exceedingly simple castings, whereas 75 per cent is altogether too high. The indications are that an average figure of 10 per cent for all kinds of castings is approximately correct, although possibly a trifle low when referred to actual production records furnished by some representative foundries.

About 97 per cent of the output of sand castings is poured from an alloy containing about 92 per cent aluminum and 8 per cent copper, known in the trade as No. 12 alloy. The rest of the output is cast from various alloys including different kinds of binary aluminum-copper alloys, aluminum-magnesium alloys, aluminum-zinc alloys, ternary aluminum-copper-manganese alloys, aluminum-copper-tin alloys, aluminum-copper-zinc alloys, and aluminum-manganese-zinc alloys. Also some exceedingly complex alloys are cast, but these make a small percentage of the total output.

The total output of light aluminum-alloy sand castings of all kinds in the United States in 1919 is placed at 81,000,000 lb. The cost of scrapping a pound of rough casting may be placed at $0.125, although variations are from $0.10 to $0.25. On the basis of the figures available, the total monetary values of the losses, incurred annually in the United States because of the rejection of defective castings, may be readily calculated.

81,000,000 pounds = total output.

10 per cent = average casting loss.

$0.125 per pound = cost of scrap.

81,000,000 = 90 per cent of the actual castings poured, or

81,000,000 ÷ 0.90 = 90,000,000;

90,000,000 × 0.10 = 9,000,000 pounds of castings scrapped;

9,000,000 × $0.125 = $1,125,000, the total monetary loss.

If the present average losses could be reduced 50 per cent, which is possible by eliminating the occurrence of readily avoidable defects, a saving of at least $600,000 would accrue to the country. That a reduction of losses by at least 50 per cent is possible, has already been shown in some large foundries.

*From Bureau of Mines Report for April, 1920.

Machining a Gear-Type Water Pump

BY FRANK A. STANLEY

Auxiliary apparatus is vital to the successful operation of internal combustion engines, though interest in the construction and manufacture of such apparatus is apt to be overshadowed by the consideration generally given to the engine itself.

THE gear pump shown in the accompanying illustrations is used on the 200-hp. gasoline engines of motor cars operated by the Southern Pacific system. The two steel gears forming the internal mechanism of this pump are of 5-in. pitch diameter, three diametral pitch and 3½-in. face.

The cast-iron casing forming the pump body is bored out to form the gear chambers to a diameter of 5.672 in. providing a total clearance outside the gear teeth of 0.005 in. or 0.0025 in. on each side. The centers to which the gear chambers are bored are of course 5 in. apart. The pump casting is shown by Figs. 1, 2 and 3 and the latter view represents the interior. It may be noted that the casing is broken out in Figs. 3 and 4 in order to show the valve seats, pipe joints, etc., in the chamber at the side.

The first operation on this work is driling the bracket holes at the side of the casing, which is done with the simple jig shown in Fig. 1. This jig is an angle plate with bushings in base and upright for a ⅜-in. drill and having a locating lug at the side for positioning the jig on the casting. The holes drilled are for the bolts by which the pump is secured in place when in service. They are also used in various machining operations for holding the work on its fixtures.

In Fig. 2 is shown the second operation, the machining of the gear chambers referred to above. This is performed on a small vertical boring mill which is fitted with an auxiliary table in the form of a faceplate having parallel slots planed across its face for locating the work-holding fixture by means of a tongue entering one of the slots. The position of the fixture along the slot

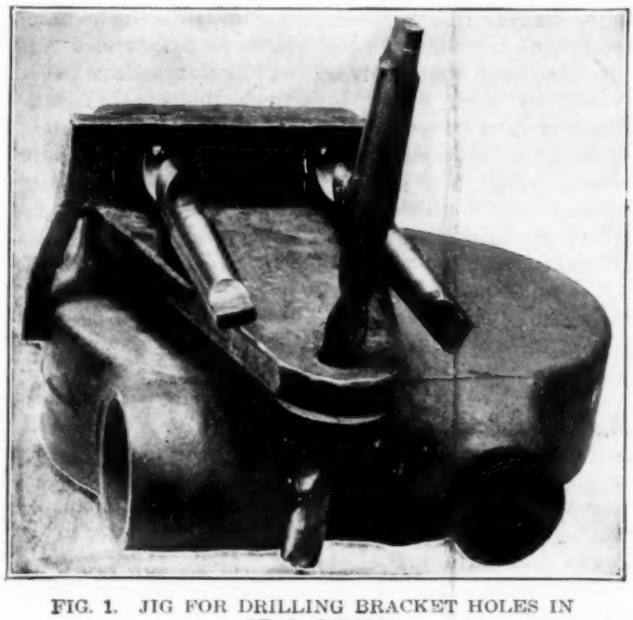


FIG. 1. JIG FOR DRILLING BRACKET HOLES IN GEAR PUMPS

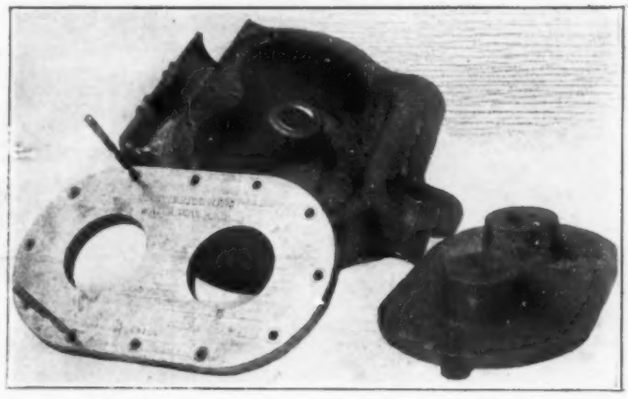


FIG. 3. JIG FOR GEAR CASE AND COVER

is fixed by a locating pin which enters a hole in the faceplate, and the center distance for the two gear chambers is readily obtained by shifting the pin to a second locating hole in the plate. The fixture is clamped in place by four capscrews, and the work is held to the fixture by three ¾-in. bolts through the holes drilled in the first operation.

There are three turret tools used in this operation. The first two are for roughing and finishing the bore and face; the third is a square-end tool for finishing the bottom of the seat. This is made narrow enough to pass down along the bearing boss at the bottom of the chamber for the gear shaft and thus reach the bottom surface which is seen in Fig. 3.

The jig for the third operation is a bushed templet, Fig. 3, which serves for the holes in both the pump case and the cover. The fourth operation is the machining of valve seats, etc., with the aid of the fixture shown in Fig. 4, which is mounted upon an auxiliary table on the vertical machine. As already mentioned, this view shows the work with the side of the valve chamber cut away, in order to illustrate the section through the walls and at the same time give an idea of the method of applying the series of tools to their respective cuts.

The sketch, Fig. 5, is a partial section showing the openings that are machined by the boring bar, cutters and taps shown in Fig. 4. There is a ¼-in. hole at the bottom of the valve chamber for the valve stem and above this comes the beveled seat for the valve. Then comes a 2⅛-in. tapped and counterbored opening for the reception of a brass valve seat and guide, and in the outer wall a 2¾-in. tapped hole for a brass valve cap. The boring bar shown in Fig. 4 carries the cutters for boring the holes to be threaded, forming the valve seat, counterboring the seat for the inserted brass valve seat, and facing the upper or open end of the chamber. These cutters are all held by hollow setscrews setting flush with the surface of the boring bar. The latter is of course piloted to enter the smaller hole for the valve stem at the bottom of the chamber.

Two machine taps are used. These may be seen on the table of the boring mill. Both are 16 threads per inch, and provided with aligning and retaining collars. The combination seating tool and drill shown in the left side of the turret will be recognized as the equip-

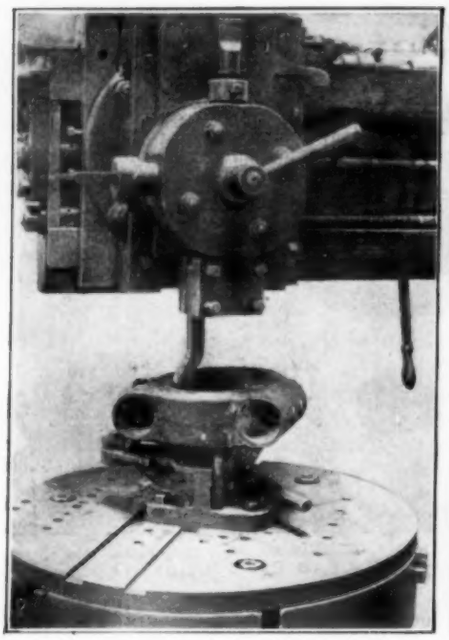


FIG. 2. MACHINING THE GEAR CHAMBER

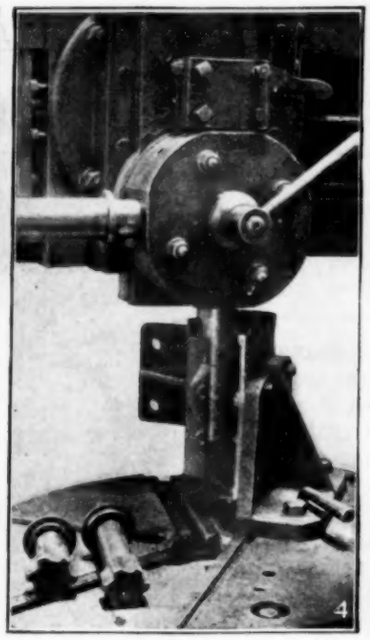


FIG. 4. TOOLS FOR BORING AND THREADING VALVE SEATS, PIPE JOINTS, ETC.

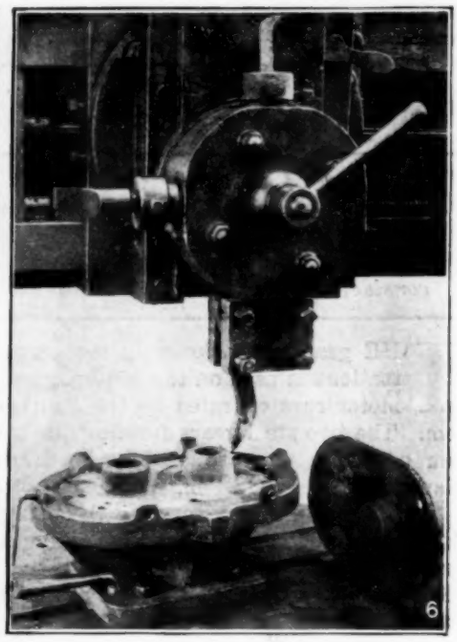


FIG. 6. MACHINING GEAR-CHAMBER COVER

ment for drilling the ⅜-in. hole at the bottom of the chamber and for forming the lower valve seat, the finishing of which is shown underway with the flat cutter in the lower end of the bar in the work. This valve seat is given its final finish by grinding in the valve in the usual manner.

The fifth operation on the pump is the machining of the gear-chamber cover which is accomplished with the fixture seen in Fig. 6. Like other fixtures described, this device has a locating pin for giving it two definite positions along the slotted auxiliary table on the boring mill, thus assuring correct center distances for the operations around the two bores and hubs. The fixture has a chamber in its upper face which admits the cover and in which the work is secured by six hollow set-screws placed at a slight angle to the horizontal to force the work down into place on its seat.

The tools described above are in use at the Sacramento shops of the Southern Pacific Railway Company.

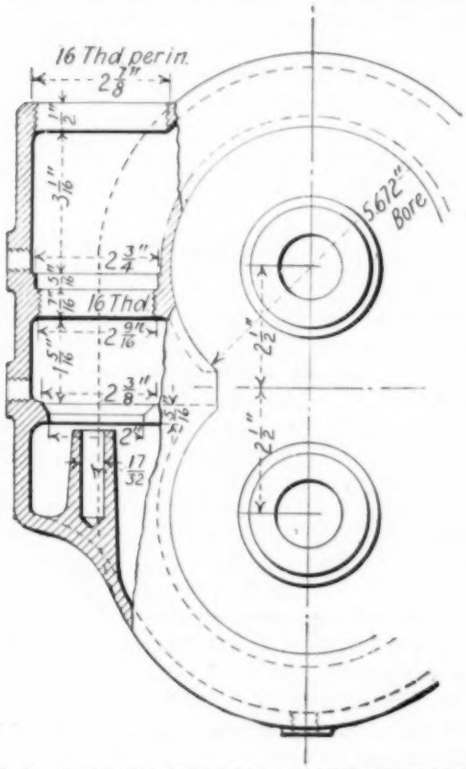


FIG. 5. SECTION THROUGH VALVE CHAMBER

Unclaimed Suggestions

BY PETER F. O'SHEA

The suggestion system of the Greenfield Tap & Die Corporation involves the use of standard blanks which are numbered serially and have a coupon bearing the same number which the employee tears off and retains to entitle him to any reward accruing from the suggestion. The employee's name does not appear on the suggestion itself. This, therefore, is sure to be considered on its own merits whether it comes from the general manager or from a truck boy who has a bright idea.

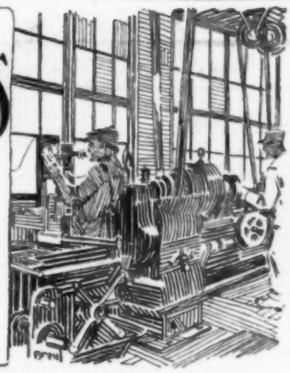
It was found that many of the suggestions are never claimed by their originators even though they may have a reward attached to them. A certain number of people have made suggestions from an entirely disinterested spirit and prefer not to have their identity known even though they pass up the reward.

They would probably say if approached that they did not make the suggestion for the reward in it, but simply that it was time such an idea was acted upon. In other words, this illustrates the tendency of the average man to want to have things go right, apart from his own personal interest.

To call the attention of the remainder of the employees to the fact that there are suggestions unclaimed, the list of serial numbers is posted on the factory bulletin boards and if this does not clean up all the suggestions the numbers are then printed in the shop paper which goes to everyone in the plant. The management always wants to know who has made good suggestions because such are the employees who are worth developing.

MODERN PRODUCTION METHODS

By
W. P. Basset
of
Miller, Franklin, Basset & Co.



(Part VII—Continued from last week)

The next step is to develop the machine load, Fig. 35, from the schedule control. The machine load is built up to give the management a guide to hiring men selling the product and, to a certain extent, in following up purchased material. The most important function is as a guide to the selling policy for the future. If the machine load is light, it becomes a guide to the management in helping them decide what to release to the shop for making to stock for expected future sales.

It should be obvious that it is impossible to produce any more work from the shop than the primary machines can handle. If, however, the first one or two operations are performed on a tool which has surplus capacity, it is not advisable to consider this as the primary operation, but to look further on down the routing and find the first operation which is of considerable magnitude or on which there tends to be a congestion of work.

Economical manufacturing dictates that the shop demand should control the receipt of material; that is, enough material should be in the plant to keep the machine tools busy. If the factory produces solely on order and does not build ahead in dull times, the sales schedules and the machine load will tie together. If the product is standard, and the machine load does not show enough work to keep the machines busy, the management must decide whether to let the machines be idle and lose a part of the organization, or to build ahead of the sales schedule and hold the finished material in stock in expectation of future business.

The machine load, Fig. 35, shows the number of hours of work ahead of each machine. We do not, however, go so far as to develop a load on the individual machine. It is only necessary, as stated above, to pick up the load on the primary machine. If there happen to be several identical primary machines, it is possible to load the group instead of the individual machine tools.

The machine load is developed from the schedule-control graph. Thus, if the schedule control shows that, during a given week, the first operation on 500 pieces of D41-1 must be performed, and that the time on that operation is 20 hours, we note on our machine load the part number, operation number, quantity and time. We keep on adding to the machine load the various operations which are performed on each group of machines until we have each group loaded. If there is more work than capacity, what is left must be loaded onto the succeeding week. We usually like to arrange the machine load in periods of a week.

Control graphs are not made out to cover all of the orders on the books. Usually, they are not made out for more than eight weeks at the most. The machine load is made up by weeks for about six weeks in advance and taken from the control graphs. All of the orders on the books farther ahead than six weeks are figured separately by formula—(a formula of machine load is made for each type of transmission)—and is very readily made up by months for all remaining orders on the books.

The machine load taken from the control graph is a guide to the works manager or superintendent for the manning of his shop. The burden thus taken off is a prophecy and is therefore not absolutely accurate, having a probable 10 per cent error. Even so, it guides the man power in a department with sufficient accuracy so that there is not the tendency to keep full crews on when it will be weeks before there is a full load on the machines of the department in question.

The machine load taken from the balance of orders is a guide to the sales department only. This being a prophecy into more distant future, it has correspondingly increased chance for error. As it is used, however, for an influence on rather broad sales effort, the need for accuracy is less.

It is easy to see that to assign a delivery date for new work, it is merely necessary to run through the machine load record to see when there will be time available for starting new work. For example, if all of the machines—except one set, which is loaded completely—will have available time in September, and

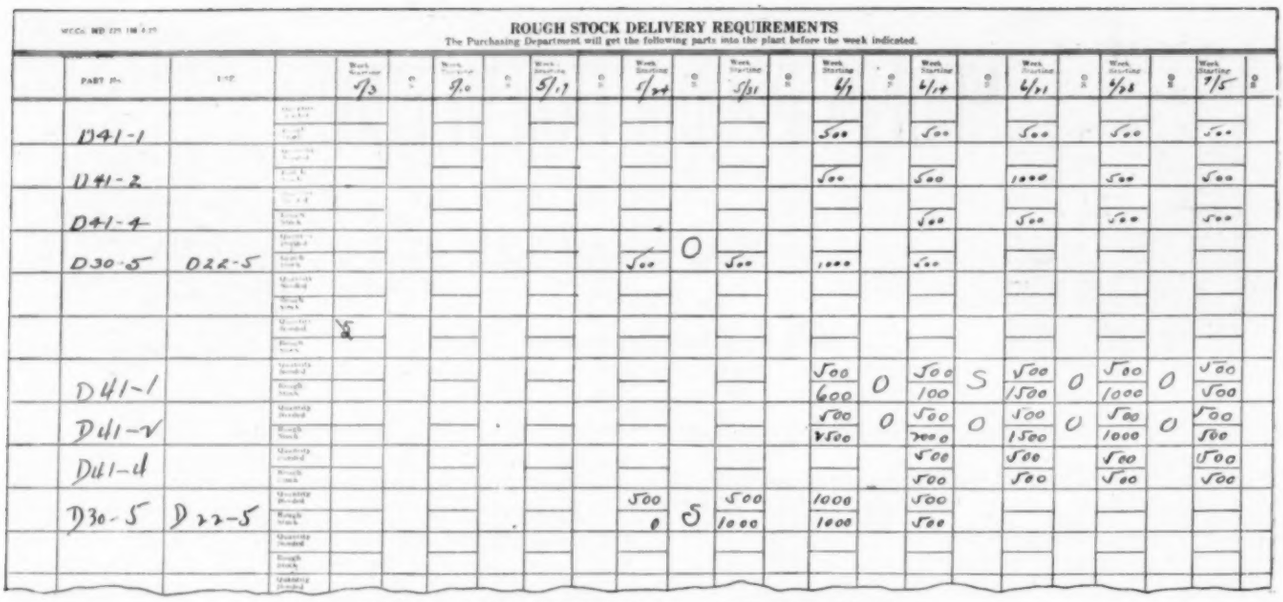
MACHINE LOAD

Period_____

Department _____

Machine 20-306-777					Time Available 50 Hrs.	Machine 68-77-21-10					Time Available 200 Hrs.	Machine					Time Available ... Hrs.	Machine					Time Available ... Hrs.	Machine					Time Available ... Hrs.
Part Number	Instr.	Oper. No.	Quantity	Time	Balance Time	Part Number	Instr.	Oper. No.	Quantity	Time	Balance Time	Part Number	Instr.	Oper. No.	Quantity	Time	Balance Time	Part Number	Instr.	Oper. No.	Quantity	Time	Balance Time	Part Number	Instr.	Oper. No.	Quantity	Time	Balance Time
D41-1		1	500	40.0		D41-1		4	500	40.0																			
		3	500	30.0		D42-1		6	500	82.6																			
T34-4		2	400	225		M12-6		2	1000	47.1	✓																		
		3	400	62.0	10																								

FIG. 35. MACHINE-LOAD RECORD



ROUGH STOCK DELIVERY REQUIREMENTS

The Purchasing Department will get the following parts into the plant before the week indicated.

PART No.	LOT		Week Starting 4/3	O/S	Week Starting 4/10	O/S	Week Starting 4/17	O/S	Week Starting 4/24	O/S	Week Starting 5/1	O/S	Week Starting 4/7	O/S	Week Starting 4/14	O/S	Week Starting 4/21	O/S	Week Starting 4/28	O/S	Week Starting 7/5	O/S
D41-1		Quantity Needed											500		500		500		500		500	
		Rough Stock																				
D41-2		Quantity Needed											500		500		1000		500		500	
		Rough Stock																				
D41-4		Quantity Needed													500		500		500		500	
		Rough Stock																				
D30-5	D22-5	Quantity Needed							500	O	500		1000		500							
		Rough Stock																				
		Quantity Needed	X																			
		Rough Stock																				
D41-1		Quantity Needed											500	O	500	S	500	O	500	O	500	
		Rough Stock											600		100		1500		1000		500	
D41-2		Quantity Needed											500	O	500	O	500	O	500	O	500	
		Rough Stock											1500		1000		1500		1000		500	
D41-4		Quantity Needed													500		500		500		500	
		Rough Stock													500		500		500		500	
D30-5	D22-5	Quantity Needed							500	O	500		1000		500							
		Rough Stock							0	O	1000		1000		500							
		Quantity Needed																				
		Rough Stock																				

FIG. 36. ROUGH-STOCK DELIVERY REQUIREMENTS

an inquiry includes parts which must pass through the heavily loaded machines, the plant can not take on that order until it has completed the existing work on the heavily loaded group.

In such an event, the management may decide to set back the delivery dates on the prior orders, in order to take on the new work. Or perhaps it can "farm" the extra work out to some neighboring concern that is not busy. In any event the decision is an intelligent one, based on the information given by the machine-load record.

Machine Load a Guide for Purchasing

Let us now see how the machine load is a guide for purchasing. From the schedule-control graph, we know just what date each part must be started in process. These are, of course, the limiting dates for receiving the raw materials. In order to obtain the material when it is needed, the purchasing department must be informed sufficiently far in advance to be able to get this material into the shop. To this end the planning department sends to the purchasing department the rough stock delivery requirements, Fig. 36. Market and plant conditions must govern, but, as a rule, we have found it advisable to tell the purchasing department what raw material the shop will need at least eight weeks in advance.

At the left of the form, Fig. 36, are placed the part numbers which are shown to be required by the machine load. If a required part is made up from some other part, the part from which it is made is indicated in the second column. The different weeks in which this material must be brought in are indicated under "week starting."

The line called "quantity needed" shows the total quantity of raw material which should be brought into the shop during that week, as shown by the machine load. "Rough stock" shows the quantity of stock already on hand. Each week, this form is extended to show any new orders received, in order to keep the purchasing department in close touch with requirements. If the rough-stores quantity is greater than the quantity needed, a letter "O" indicating "overage" is placed in the column headed O/S. If the rough stock available is less than the quantity needed, a letter "S," denoting shortage, is placed in the same column instead of the "O." When additional stock is received, if the quantity is great enough to overcome the shortage in any given week, a letter "O" is placed around the "S" indicating that the shop is covered to that point, and any balance that is left is applied against the succeeding weeks, until it is exhausted.

Now we are at the point where we want to lay out a schedule of the work on the individual machines. This is done graphically on the machine schedule, Fig. 37, from the information furnished on the production routing sheet.

Opposite the number of each machine in a department is drawn a line showing the length of time each series of parts will be on the machine. It is really but a detail of the schedule-control graph for the latter schedules simply as to operations, while the former specifically assigns the work to a definite machine. This record is kept in the central planning department and the actual performance is entered on it daily, as will be explained later, so that future assignments can be adjusted to today's performance.

The Machine Schedule

The machine schedule is laid out to cover one or two weeks. On the left-hand side are listed the numbers of all machine tools in the department. The distance between two vertical lines represents an hour of elapsed time.

From the production routing sheet for parts D41-1&2, the schedule man notes that the time required for operation 1 is two hours per lot, or 20 hours per series. He sees also from his routing that it is possible to perform this operation on machines 204, 206 or 227. He notes from his machine schedule that machine 204 will be available at 8 o'clock Monday morning, machine 206 at 12 o'clock Monday noon and machine 227 at about 10 o'clock Thursday morning. He might decide to schedule his work on the first two machines so as to bring out his 10 lots at about the same time, or he might schedule the operation altogether on either machine 204 or 206. Let us assume that he decides to schedule it all on 206. His first step is to draw a

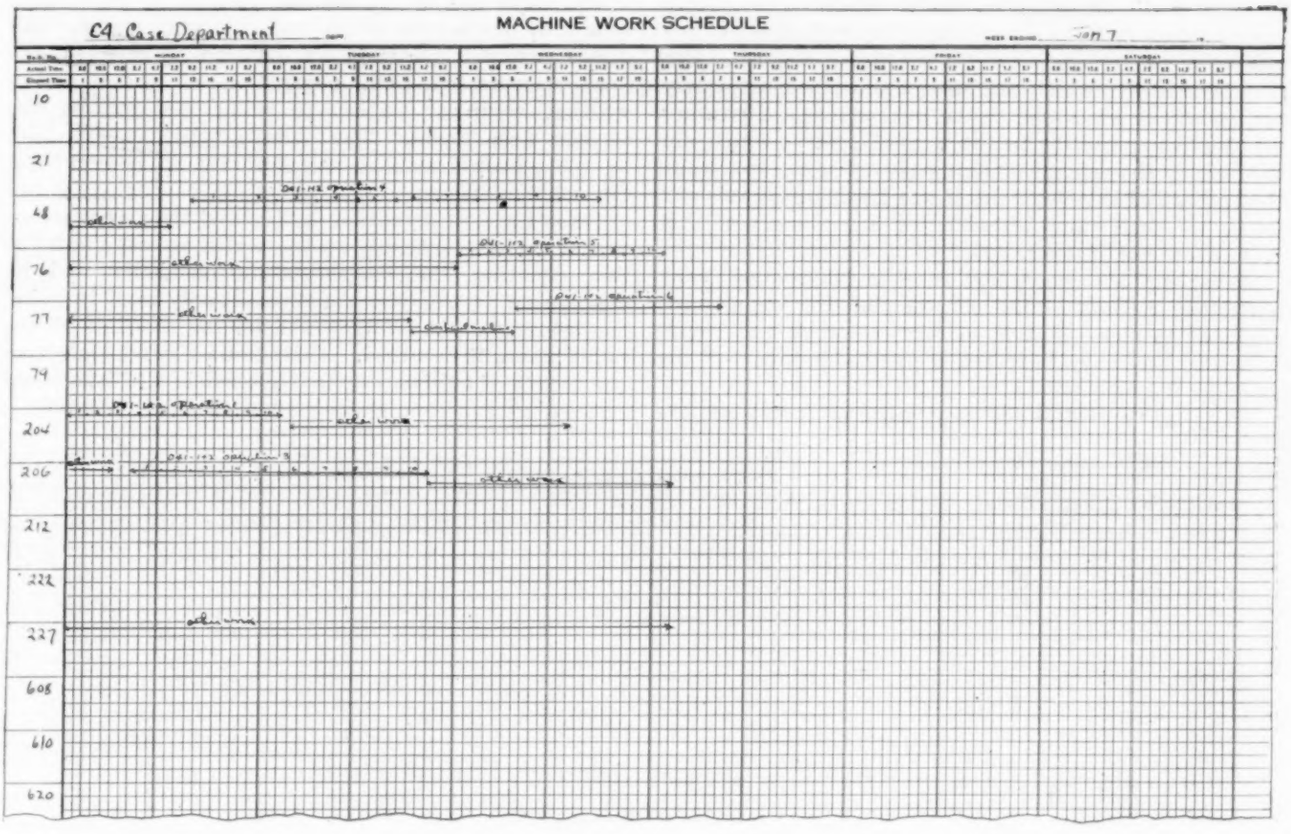


FIG. 37. MACHINE WORK SCHEDULE

line enough over 20 hours long to cover the set-up. This line he marks off to indicate the lots. Over this line he writes part, lot and operation number, and so on, for each of the ten lots. It is advisable, on the machine schedule, not to attempt to schedule more than three days ahead, because conditions will arise in the shop such as machines being down for repairs, operators being off, and the hundred and one ailments to which a machine shop is heir, and which are liable to disrupt any plans.

After having scheduled the work on the first operation, if the second should start immediately, the first lot should be scheduled in on the machine required, leaving a lapse of six to ten hours between the time it should finish on the first and when it should start on the second, to allow for inspections and trucking between operations.

After drawing in the line representing the first lot on operation 1, the machine on which operation 2 is to be done should be noted, below the right-hand end of the line, and when operation 2 on the same lot is scheduled and drawn in, a red check should be put against the first operation. By means of this check-mark it is possible, by looking over a schedule sheet after it is supposed to be completed, to tell whether all lots have been carried forward, and no sheet should be discarded until all lots are checked in order to make sure that none are dropped. If this were not done, an important lot might become sidetracked and not worked on for weeks.

When the schedule man schedules the last operation in his department he passes the tickets for all following operations on to the man scheduling the next operation, with a note as to the approximate time when the parts should reach the next department. This gives the next schedule man an advance notice of work that is on the way to his department, and so allows him to prepare to receive it when it arrives. The first schedule man will also ask the second what machines the work will go onto in his department and will then place this machine number on the move order and service card.

Advantage in Keeping Machines Busy

The purpose of the machine schedule is to keep the fewest possible number of machines busy all of the time and still keep ahead of the schedule of work. It is much better to have five machines busy all of the time than six most of the time, as the operators are kept more contented by means of it.

Where there are several machines close together on any one of which the same operator can work and on which the operations are generally very short, the machines may be taken together and scheduled as a group. In scheduling for a group, place the machines on the schedule sheet the same as before, but note in a bracket down the side by the machine numbers that they comprise a group. In drawing in work, no attention is paid to which machine will probably run it, but each one is loaded in turn until all work to be done is taken care of. If there were four machines in a group one might show as having no work scheduled to it at any time, but still might actually be used all of the time and some other one be the idle one.

The schedule man should keep close watch on the amount of idle time in his department and should make recommendations as to the taking on and letting off of men or as to the advisability of working overtime.

We have now determined when we shall start our work and have made sure that the raw material will be in the plant in time. Really, the next logical step is,

to show how the progress of the various parts from rough stores through the shop is controlled until they arrive in a completed state in the finished stock. But that is a subject which can best be described separately and so will be discussed in the next article. There are a few other activities in the way of control which are handled by the central planning department. So, while the records of this department are fresh in the reader's mind, we shall jump ahead a bit and show how this central control is exercised.

So far we have shown how the schedule-control graph and other records of the central planning department are used to plan—that is to foresee—work and needs. It is also necessary to record the actual progress of the work in the shop.

When an operation on any part is completed the central planning department is notified by a copy of the workman's service card and that information is noted on the graph.

This is done by placing a large headed pin at the first dot on the first operation, or on whatever operation or lot the service card calls for.

If on any date all of the pins for the parts of an assembly are ahead of that day's line, all is going smoothly on that particular assembly. But if some of the pins are several days ahead of the line, and the rest are lagging from five to twenty days behind, an effort should be made to bring the laggards up. If any of the parts which are behind can be done on the machines that are doing the operations on the parts which are ahead, the schedule man should divert these machines to the slow-moving parts, in order to bring them up even with the others. Balanced production is what the schedule control aims to give, and if it even appears impossible to make the assigned date for an assembly, the production man must remember that it is far more important to have all the parts come out at the same time, even though a few days late, than to have 90 per cent arrive on time and 10 per cent fifteen days later. It is finished assemblies we really want—not finished parts.

After the information on the service card has been reflected on the schedule control, the next step is to post the information it contains on the operation check sheet, Fig. 38. This operation check sheet is really an analysis of the work in process in the shop. Not only does it give quantities but it also shows which lots are lagging and which are moving ahead. It is also used by the production manager to keep track of the operating end, so that he can see whether or not the different operations are being performed in the proper time.

The third use of the service card is to keep up to date the production stock and demand record. All pieces that are not good are entered as rejected, the final classification and disposition of these pieces, whether scrap or reclaimed, being reported by the salvage department. The service card is next used by the schedule man to ascertain the total time that the job has taken.

When the first operation is done and the report comes to the machine schedule on the white service card, the line denoting the corresponding operation will be checked off in blue and the time actually used in doing the operation will be drawn in on the schedule at the point where it occurred. This shows the schedule man the degree of efficiency of that job and if the time taken is over 10 per cent greater than the time allowed, it is reported to the general foreman in charge of that division who investigates the matter immediately.

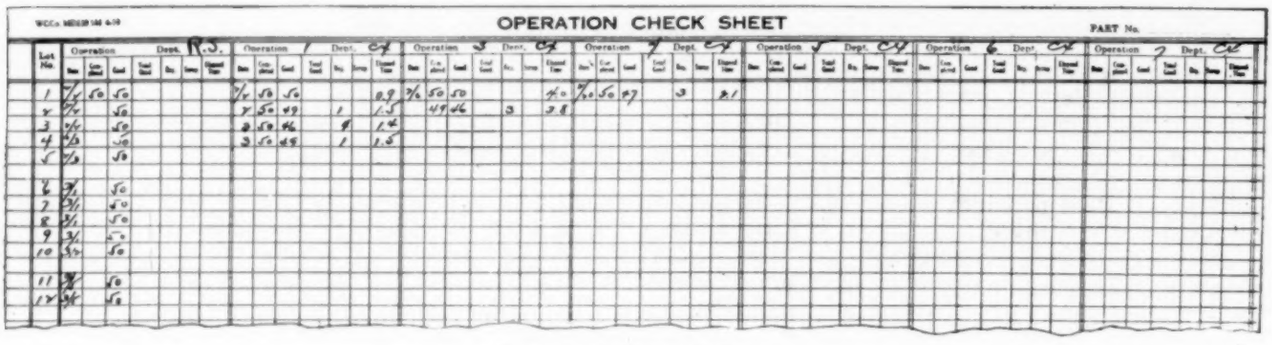

OPERATION CHECK SHEET

FIG. 38. CHECK SHEET

The white copies of service cards for completed operations are brought in to the schedule man at least every half hour.

These copies keep him in very close touch with his department. The operation is checked, as frequently the lot will be worked on several hours or even days away from the time it is scheduled and as a result it might be difficult to find which lots were done or yet to be worked on.

The machine schedule man thus can keep ahead of the shifts in scheduling, which becomes necessary when the work in the shop—as invariably happens—varies from the standard or estimated time given on the machine schedule. This does not mean that he has to go back and change what he has already done, but means that he can—in scheduling another day's work—observe how departure from the standard for the last few days will affect his future plans.

We have now seen how the central planning department lays out the work for the shop, and how it checks up to make sure that the shop lives up to schedule. But plans, no matter how good, are worthless unless they are executed, and many planning systems fail because the plans of the somewhat remote central department are not followed by the shop. How the planning is carried to the men in the shop will be described in the next article.

Fixed Habits of Thought

A lady on being told how easily (?) the metric system could be learned replied, "I do not believe I could ever learn the meter, so as to think of it other than as 1 yard 3 inches and a little more."

Are You a "Before-and-After" or a "Single-Track" Man?

BY HERMAN L. WITTSTEIN
Works Manager, The Chapman Valve Manufacturing Company, Indian Orchard, Mass.

The method which was employed in solving a problem encountered in the shop is the subject of this article. The author shows both the right and the wrong way of attacking a problem, and he emphasizes the importance of making a thorough analysis before rendering a decision as to the solution.

ONE of the chief difficulties I have experienced with the average man, be he shop mechanic, foreman or clerk, is due largely to the fact that he is not a "before-and-after," but a "single-track" man. By "before-and-after" I mean a man who has perspective, who analyzes conditions both leading up to and subsequent to a difficulty—a man who does not lose sight of the whole in too close a scrutiny of a small integral portion of it. Your "single-track" man sees the difficulty and, without hesitation, sails right in to overcome it—hammering away with one idea only in mind. He jumps to conclusions quickly, and the great difficulty seems to be in getting him to stand off and study his problem from all angles. In a good many cases it is much better and cheaper to go around than to go through.

To illustrate the foregoing, we recently experienced considerable trouble due to an abnormally large percentage of rejections in the testing of brass gate valves of the type illustrated in Fig. 1. Too many of these valves, all sizes, were failing to pass the test on account of leakage at the joint *A* between the cap and body. The manner of testing was to apply pressure on one side of the closed gate, and note whether there was any leakage past the gate *B* or at the joint *A*. There was no trouble in obtaining a tight job on the gate, but a very large percentage of the valves were rejected as "leakers" at *A*. Our "single-track" man started right in hammering away at the threading of the cap—in his judgment this was the whole source of the trouble. As was found later the threading had nothing whatever to do with it. He went right ahead, however, trying solid dies and self-opening dies and in every conceivable manner attempting to improve something which needed no improvement.

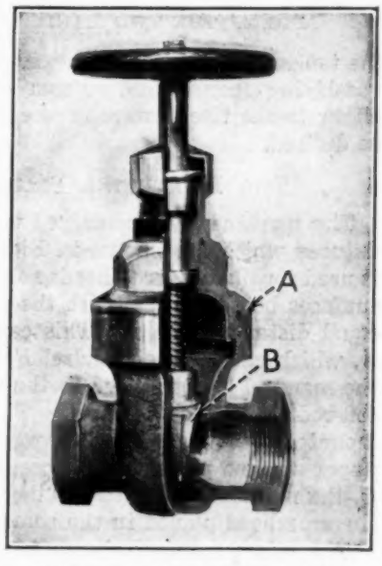


FIG. 1. BRASS GATE VALVE, SHOWING POINTS OF POSSIBLE LEAKAGE

When the matter was finally brought to the writer's attention the "single-track" man was instructed to check up very carefully each operation of both the body and cap.

No defect was found in the body; but the trouble was very quickly located in the cap, with the result that it was immediately cured. The percentage of "leakers" was reduced to a negligible number, and at the same time an operation was eliminated, thereby reducing the cost of manufacture.

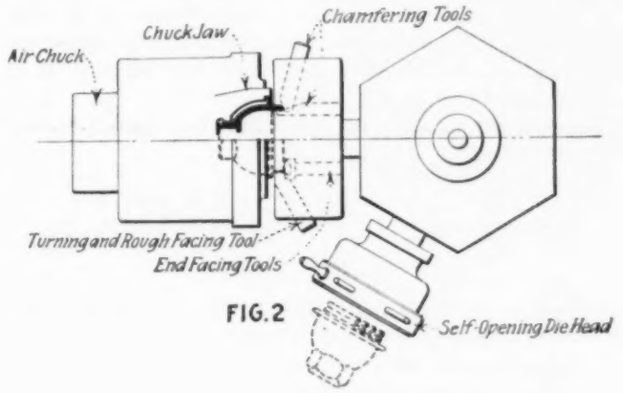


FIG. 2

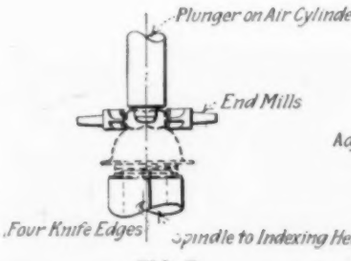


FIG. 3

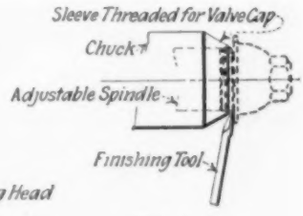


FIG. 4

FIGS. 2 TO 4. MACHINING OPERATIONS ON THE VALVE CAP

Fig. 2—Method of machining the flange. Fig. 3—Milling the nut. Fig. 4—Finishing the flange face, before the trouble was analyzed.

SEQUENCE OF OPERATIONS

Figs. 2, 3 and 4 show the sequence of operations used before the trouble was analyzed for finishing the flange on the cap. It will be seen in Fig. 2, that one tool *C* turned the diameter, which was later threaded, and also rough faced the flange which formed the joint. Fig. 3 shows the next operation, the cap being held against the knife edges while the faces of the nut were milled. If the knife edges were not properly set or were so broken as to burr the lower face of the cap, the latter would not set true when screwed into the chuck against the adjustable plunger for the finishing operation shown in Fig. 4. This caused angularity in the facing of the flange and consequently a poor fit at the joint *A* (Fig. 1) when the cap and the body were assembled.

It was decided to finish face the cap at the first operation instead of roughing it, Fig. 2, and to eliminate entirely the operation shown in Fig. 4. While this takes slightly longer than the operation of rough turning, and there is a little more frequent grinding of the tool *C*, there has been a marked saving in the cost of machining the caps, to say nothing of the elimination of the previous disassembling and salvage cost of "leakers."

This was a perfect solution of the problem, the trouble lying "after" the point where the "single-track" man made his attack. He is now a confirmed "before-and-after" man.

I have seen so many similar cases where the trouble has been either before or after the point of attack that I cannot emphasize too strongly this general principle of procedure.

Develop perspective—it saves time and money. Be a "before-and-after" man.

Some Small Railroad Shop Devices

EDITORIAL CORRESPONDENCE

Although the Savannah shops of the Central Railroad of Georgia are not large, they handle considerable work and contain a number of interesting devices. In common with practically all railroad shops, the equipment is not modern in many ways although it has a few fairly up-to-date machines.

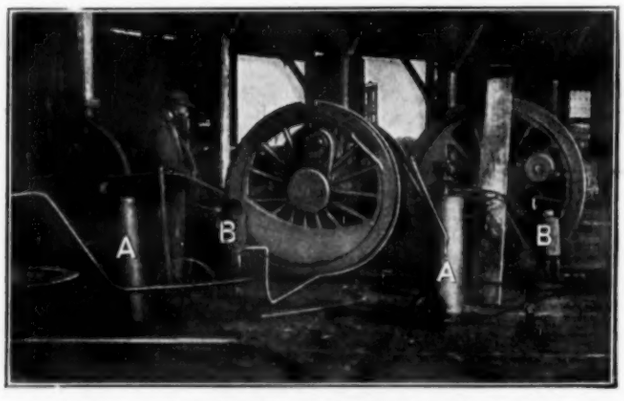


FIG. 1. PORTABLE OIL HEATING FURNACES

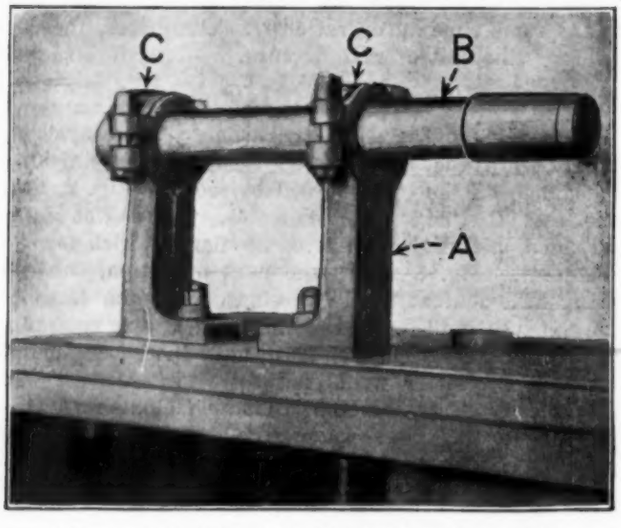


FIG. 2. MANDREL FOR PLANING CROSS-HEADS

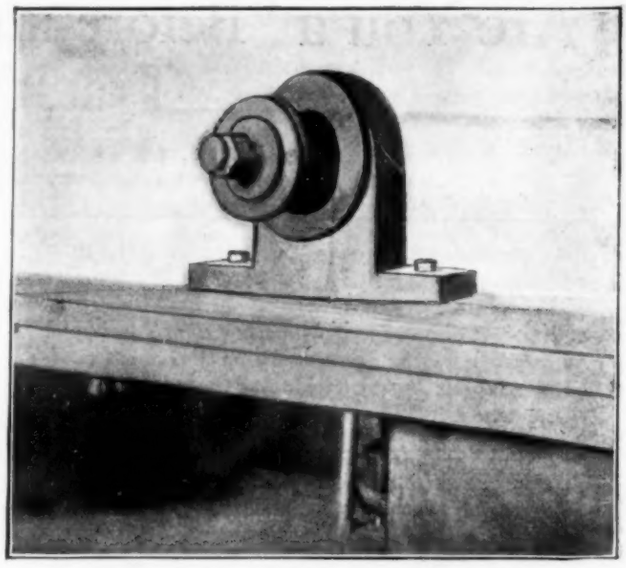


FIG. 3. MANDREL FOR PLANING ROD BRASSES

Among the special equipment noted was the portable oil heating-apparatus for use in connection with the removing and replacing of tires on locomotive drivers and also for other purposes where heat was necessary in isolated places. Fig. 1 shows two forms of the portable furnace used, the main difference being in the kind of wheels provided and in their load carrying frames.

These devices simply convert the fuel oil carried in

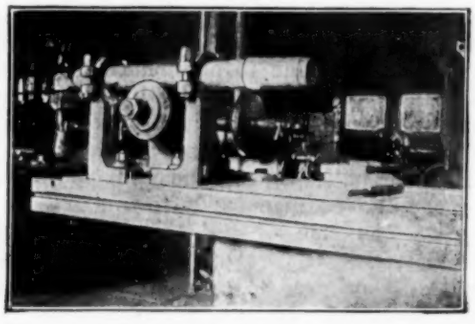


FIG. 4. THE TWO MANDRELS OUT OF USE

the tanks *A* into a gas by means of the regenerating or gassifying furnaces *B*. From here the gas is piped either to the tire heaters or used in any way that may be desired.

TWO INTERESTING PLANING FIXTURES

The machine shop contained two interesting planing fixtures which are shown in Figs. 2 and 3. The first is used for planing crossheads so as to insure the sliding surfaces being parallel with the piston rod and also an equal distance from it. This consists of a framework *A*, which carries the mandrel *B*, the projecting end of the mandrel being turned to the same taper as the piston-rod fit in the crosshead. The crosshead is simply mounted on this as though it were a piston rod and the upper surface planed. By loosening the clamping bolts *C*, the mandrel is turned 180 deg. and the other side of the crosshead planed in the same manner.

The other mandrel shown in Fig. 3 is for planing connecting-rod brasses. The brasses are first bored and then clamped on the mandrel shown, suitable bushings being used to fit the brass and insure the box being held

centrally. The box can then be easily turned so as to present all four sides for planing.

These are simple fixtures which answer their purposes admirably and they are kept at the end of the planer table, as shown in Fig. 4, so as to be always ready when wanted. Master Mechanic S. A. Whitehurst and Foreman G. C. Shivers keep things moving as well as possible with the facilities available.

Washing Ball Bearings

BY E. A. DIXIE

The caption for this article should have been "Washer for Ball Bearings" but as it might have been imagined that I meant a round flat thing with a hole in it instead of a very ingenious little device for washing them, the title was altered to what it now is.

The spindle of the Taylor & Fenn bore-grinding machine runs in ball bearings. Anyone who has handled

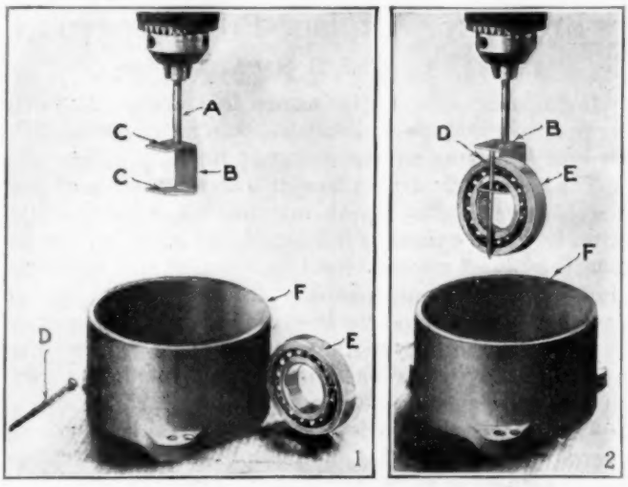


FIG. 1. THE BALL BEARING WASHING OUTFIT
FIG. 2. BEARING IN PLACE IN THE FIXTURE

ball bearings as they come from the factory knows that they come filled full of vaseline. The high-speed spindle of a bore-grinding machine must be mounted as nearly rigid as it can be so far as any shake is concerned, but it must run as freely as it is possible to make it run.

During the operation of assembling the spindle in its housing, dust and other foreign matter is almost sure to get into the bearings where their presence is detected by the binding of the spindle when in certain positions. When dust does get into a bearing of this sort the only thing to do is to thoroughly clean out everything in it, including the vaseline. This is a tedious job and takes a lot more time than one would imagine. After having washed out a number in the old tedious way, the young Scotsman who has charge of assembling the spindle units decided that it was taking far too much time, so he devised the simple little washer shown in Figs. 1 and 2, which is used in conjunction with a sensitive drilling machine.

The shank *A*, Fig. 1, is a piece of ¼-in. drill rod about 4 in. long. Riveted to this is the bent piece of cold rolled flat steel *B*. It will be observed that there are two holes *C* about ⅛-in. in diameter in *B*. These are a loose fit for the common wire nail *D*.

The application of the device to the washing of bearings is shown in Fig. 2. The bearing *E* is placed in the bent member *B* and the nail *D* is passed through the holes *C* to prevent the bearing from being displaced from its seat in *B* when the drilling spindle is running.

On the table of the drilling machine and under the spindle is the receptacle *F* which is filled with kerosene or gasoline. With the spindle of the drilling machine in motion the rotating bearing is lowered into the liquid in *F*. This not only washes out all the vaseline but the dirt along with it and these heavy particles fall to the bottom of *F*.

With this simple device twenty to thirty bearings can be washed perfectly in less time than a single bearing could be done by the old method where it was often necessary to remove the balls and cage in order to make sure that every particle of dirt was removed.

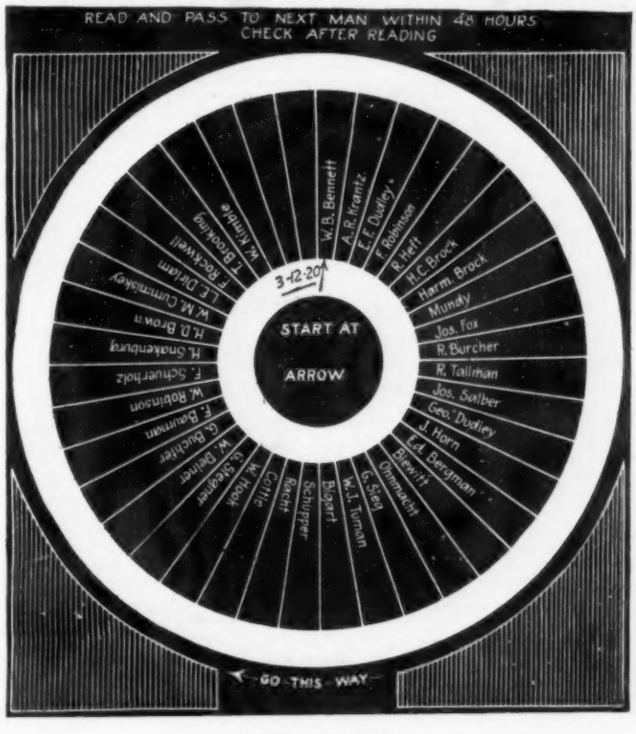
A Routing Panel

BY W. B. BENNETT
President Wayne Engineering Works

In your issue of March 4 the writer noticed, at the top of the cover, the following: "Are you using the routing panel? It's on the Contents page." Noting the way you have arranged this panel we thought you would perhaps be interested in our method, which has been in use in this plant for over a year.

The sketch reproduces one of the blueprint sheets that we attach to every magazine or catalog which is received here and which we think will be of interest to various employees. Previous to making out these sheets we made a canvass of every department and found out the names of those men who would be interested and who would read the periodicals in question. Thus the sheet we are sending you is representative of a department.

In a way it is more flexible than your list, because the individual who receives and issues the magazines can determine the proper name to start with, with reference to its importance. For example: if there



ROUTING PANEL

are several important items which would be valuable to a foreman or gang boss at an earlier time than to some other workman, the magazine is first directed to him.

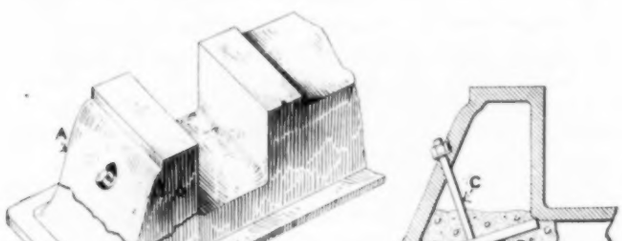
The round white border is reserved for checking off. When the list is complete the magazine is returned to the planning office where the reading matter is cut out and properly filed.

The credit for this design belongs entirely to our Chief Engineer, Mr. William Cummiskey.

Repairing an Air Compressor

BY FRANK C. HUDSON

The illustration shows a pillow block on an air compressor which parted along the broken line, just when it was needed to keep up the air service for pneumatic tools and other work in the shop.



HOW THE PILLOW BLOCK WAS REPAIRED

Getting a new bed within three months was out of the question and the compressor was needed every minute.

The broken part *A* was taken out, and a plate *B* was made to go inside the cored space in the pillow block. The stud or double-threaded bolt *C* was next made of the proper length to reach up through the broken part *A*, which was then drilled for the bolt and spot faced for a collar or washer under the nut.

Locating the plate *B* in its proper position, the plate and stud were grouted into position with some concrete mixed to flow freely. After this was poured, the broken part was put back with the upper end of the stud through the hole drilled for it.

When the concrete had thoroughly hardened the collar and nut were put in place and the broken part drawn down into place. The shape of the break helped to hold it in place and it has now been used for about two years with no sign of giving way.

Theory (Calculation) vs. Use

In discussing the pros and cons of the metric question, it has been aptly said that the pros are represented by the *pro*fessors and the cons by the *con*structors.

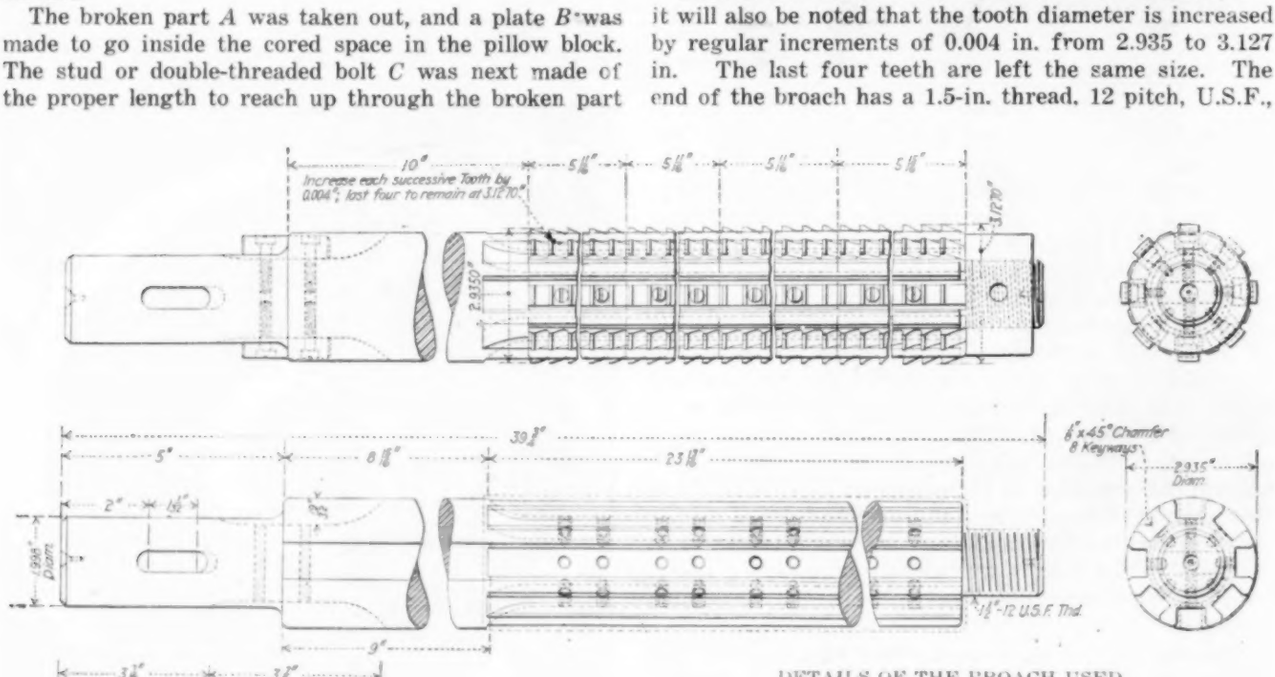
Broach for Airplane-Propeller Hub

BY I. B. RICH

Definite information in regard to broaches of fairly large size is not always available, this being particularly true of broaches having sectional teeth.

The broach illustrated herewith shows the practice of the Lincoln Motor Co. in making the splines in the Liberty motor propeller hub which has to be a close fit. The body is of machine steel, carbonized and hardened, the eight slots being chamfered $\frac{1}{8}$ in. and at 45 deg in order to leave grooves between the sides of the inserted cutters and the body. Allowance is made for grinding after the body is hardened, in this way taking out what little distortion may be due to spring.

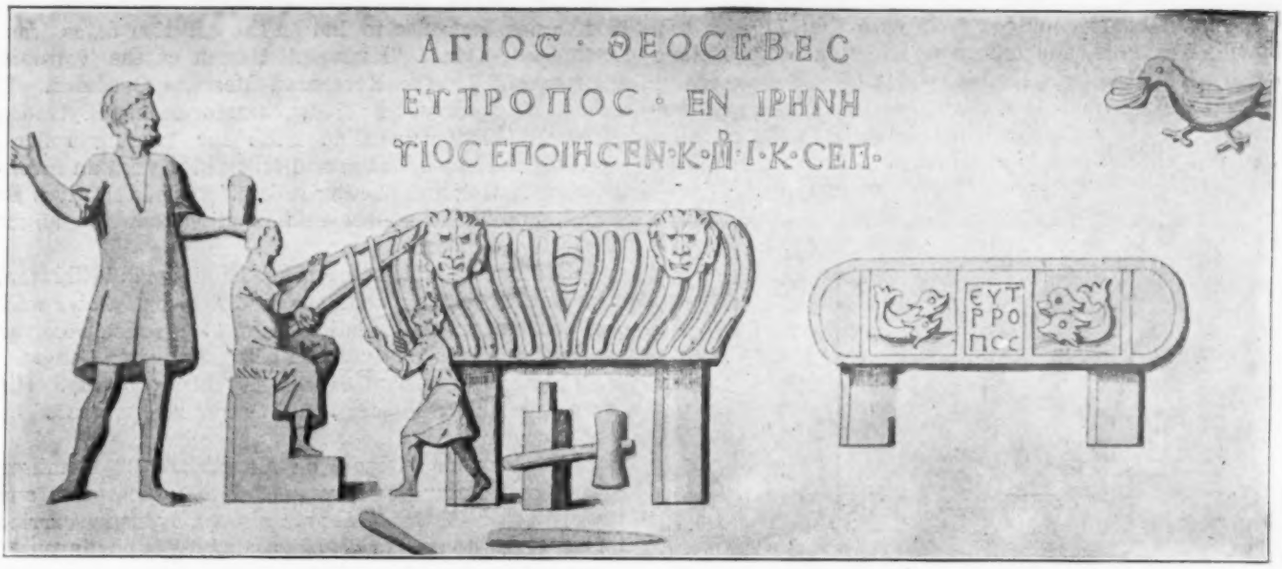
The broaches are in four sections as can be seen, and it will also be noted that the tooth diameter is increased by regular increments of 0.004 in. from 2.935 to 3.127 in. The last four teeth are left the same size. The end of the broach has a 1.5-in. thread, 12 pitch, U.S.F.,



DETAILS OF THE BROACH USED

this carrying the collar which takes most of the thrust of all the broaches. The exact dimensions are given and will be useful for reference.

The sketches shown here give a good idea of the broach used in this operation.



The Evolution of the Workshop—X

By H. H. MANCHESTER

After the English colonists had introduced the art of metal working into America the colonies began to develop rapidly along industrial lines. The growth and development of the system of workshops tells an interesting story of the enterprise and genius which characterized the citizens of the new country. This article treats of the metal-working industry in America up to 1810.

(Part IX was published in our June 3 issue.)

BEFORE the discovery of America by Columbus the Indians knew nothing about working iron. The Aztecs of Mexico and the Incas of Peru were quite skilled in the handling of gold, silver and copper, and in what is now the United States the aborigines valued copper so highly that runners were sometimes sent a thousand miles to obtain a little of it, but they employed only the simplest tools. Fig. 61 shows the first picture of an American workshop which was printed, the explorer Benzoni being credited with the making of it.

The first attempts to work iron in the United States seem to have been made in Virginia by the European colonists. In 1585 Raleigh's expedition reported having discovered iron ore there, and according to a statement of the time by Francis Maguel there was an attempt to manufacture iron in that colony in 1610, only three years after the founding of Jamestown. The settlers started to build a furnace on Falling Creek in 1619, but it was destroyed in the massacre of 1622.

FIG. 61. THE EARLIEST PICTURE MADE OF A WORKSHOP IN AMERICA, PERUVIAN OR INCA METAL WORKERS FROM BENZONI, 1565

At that period the colonists were keen to discover iron ore because the forests of England were giving out and the only known fuel for smelting was charcoal or wood. In Massachusetts a monopoly for smelting was temporarily granted as early as 1641, and Saugus bog ore was mentioned in 1642. The first iron works there seem to have been begun at Lynn about 1644.

In 1646 probably the first patent to an American machinist was given to Joseph Jenks for an improved scythe and edged tools and a more efficient mill with which to make them. The improvement in the scythe was simply an added thickness to the back of the blade which permitted it to be increased in length. In 1652 Jenks made dies for the new mint, two years later a fire engine for Boston, and in 1667 he was loaned by the colony a set of tools for drawing wire.

The first slitting mill in America seems to have been set up at Milton, Mass., by 1650, not so many years later than such mills were first introduced into England. Soon afterward there was one at Middleboro and two in Hanover. By this date the colony had also a steel furnace, and a plating forge with a tilt hammer. In 1710 another slitting mill was started by Jackson in Dorchester, and a foundry by Joseph Mallinson at Duxbury. A mill for grinding scythes was set up at Andover in 1715, and in 1720 Nathaniel Ayres began heavy forging at Boston. In 1732 there were six furnaces and nineteen forges in New England. At Bridgewater, Mass., Hugh Orr began

the manufacture of edged tools with the aid of a trip hammer in 1738, and ten years later made 5,000 stand of arms for the province.

In 1750 Parliament forbade the importation of machinery or even of skilled machinists into the colonies, and did all it could to discourage American manufac-

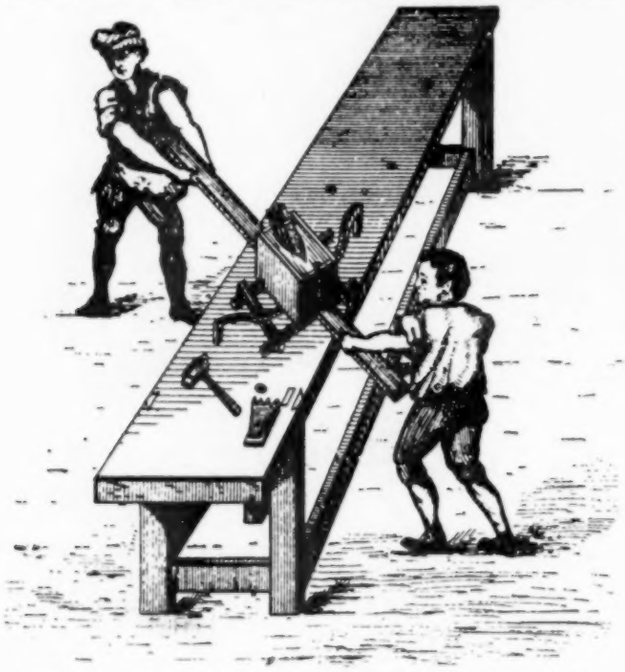


FIG. 62. A PLANING MACHINE IN THE U. S., 1775

tures. This law was based on the prevalent "mercantile theory" of political economy that the colonies should supply the raw materials and the mother country the manufactures. At any rate the law did much to retard the development of the machine shop in the colonies.

Many of the devices and machines which were developed at this time were for the cutting of wood, some of them being shown by Figs. 62, 63 and 64; but they furnished the experience necessary for the building later of metal-working machinery.

In 1775 Nathaniel Niles of Norwich began to manufacture iron wire to be used in cards for wool, and two years later Oliver Evans of Philadelphia constructed a machine to make such cards.

One industry which originated in America was that of cut nails. As early as 1775 Jeremiah Wilkinson of Cumberland, Rhode Island, was cutting out small tacks and nails and forming the heads in a vise. Other machines for nail cutting were designed by Ezekial Reed in 1786, who lived at Bridgewater, Mass., and by Samuel Briggs of Philadelphia in 1789. Briggs' patent was a general one for nail, screw and gimlet machinery, and the first one of that scope. Probably the most important of the early nail manufacturers was Jacob Perkins, who in 1790 established at Newburyport a mill for both cutting and heading nails by machinery. In the next decade there were twenty-three patents taken out in this field.

In 1790 Samuel Slater and Sylvanus Brown built the first cotton mills in America at Pawtucket, R. I. It has been declared that in constructing the machinery according to Slater's designs, Brown invented a slide lathe. If this has not been exaggerated, it is important, for the date is earlier than that assigned to Maudslay's slide rest. The earliest reference, however, which the writer has been able to find on the question dates from 1866, and is in a "Historical Sketch of the Town of Pawtucket," by the Reverened Messana Goodrich. It reads, "As early as 1791, therefore, he (Sylvanus Brown) invented a slide lathe for turning rollers, spindles and like articles; and followed it with an invention for fluting and planing rollers." Goodrich gives no proof, and as it stands this is altogether too slight authority to be convincing.

There is no doubt, nevertheless, that David Wilkinson, who worked on the machinery for the second Slater mill, had constructed a slide lathe before 1798, for he received a patent for it in that year. Fifty years later, Congress voted him a reward of $10,000 for his invention. His lathe was applied to screw cutting and later operated by water-power at Pawtucket.

In his famous "Report on Manufactures" Hamilton stated that water power was used to make spikes and nails, but added that this was also an industry carried on largely at home. In 1797 Benjamin Seymour invented some rollers for slitting mills. The next year Robert McKean took out a patent applying steam power to saw mills.

Beginning of the System of Interchangeable Parts

Eli Whitney, who was getting little return for his epoch-making invention for ginning cotton, in 1798 signed a contract to manufacture 10,000 stand of muskets for the government. He expected to do this in two years, but it was ten years before the contract was completed. A very important point about his work was that he attempted to make the parts interchangeable, and to do so, built or invented machines to produce the parts in order to have them more accurate and uniform. Thus the idea of fabrication in quantities rather than finishing piece by piece was, so far as practical application goes, born in America. When this method was later tried in Europe, it long continued to be known as the "American system."

A planing machine was patented by John Bennock in 1805, and the next year a method of welding iron and steel by Daniel Pettibone. In 1807 Jesse Reed of Boston patented an important machine for cutting and heading nails at one operation, Fig. 65 being a reproduction of an

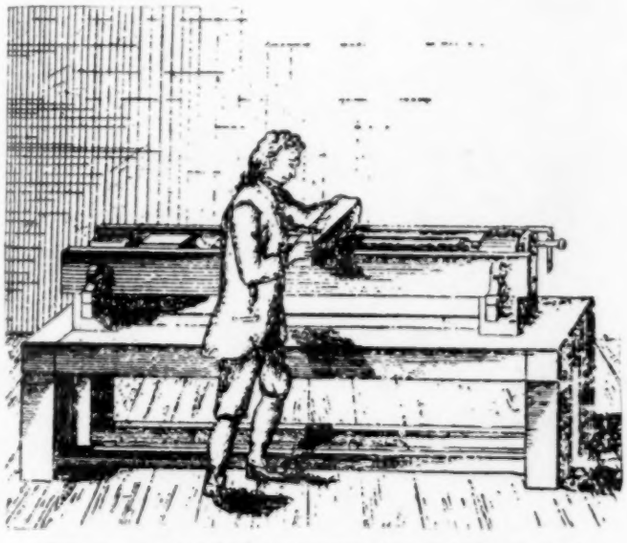


FIG. 63. A MOLDING MACHINE IN THE U. S., 1775

old print of the machine. Two years later fifty-two of his machines were said to be in service in the United States.

The first fairly complete conception of the industries of the country which dealt with iron and other metals is given by the reports of the United States marshals that were made for the census of 1810. On the one hand these are incomplete and on the other they include among manufactures, products which were made in the homes, but this was at the time a highly considered method of manufacture.

The largest number of forges was in Pennsylvania, which had 78, producing 10,969 tons of iron with a value of $1,156,405. New York, Connecticut, Massachusetts and Virginia followed in the order named. The incomplete returns of the country listed 329 in all, and there were undoubtedly a number of others. Vermont, which with 26 forges ranked fifth, had the largest number of trip hammers, 65, at work, with Pennsylvania, New York, New Hampshire, Rhode Island and Connecticut all having above thirty. There were 316 in all in the no doubt imperfect lists sent in by the marshals.

There were 42 rolling and slitting mills enumerated in the country. Of these Pennsylvania had 18, producing 4,502 tons of rolled iron and 98 tons of slit iron. The value of their combined products was given as $606,426. In this field Massachusetts was a bad second with only five such mills.

Importance of the Nail Industry

The most important metal manufacture of the country was undoubtedly nails. The marshals listed 446 naileries, and a great many were produced in private families. The leading state in nail fabrication was Pennsylvania, where there were 175 factories producing 7,270,825 pounds of nails with a value of $760,862. Massachusetts with only 36 nail mills was a close second in the value of the product, while Vermont with 67 nail makers make only $34,560 worth, which suggests that the work there was carried on chiefly in blacksmith shops or at the home. Ranked according to the value of the nails produced, New York was third, Maryland fourth and New Jersey fifth. The industry had even spread beyond the mountains, for the eastern district of Tennessee, though noting only four nail mills, claimed a production worth $104,406. There were also nailéries in Ohio, Kentucky, the western district of Tennessee and Indiana.

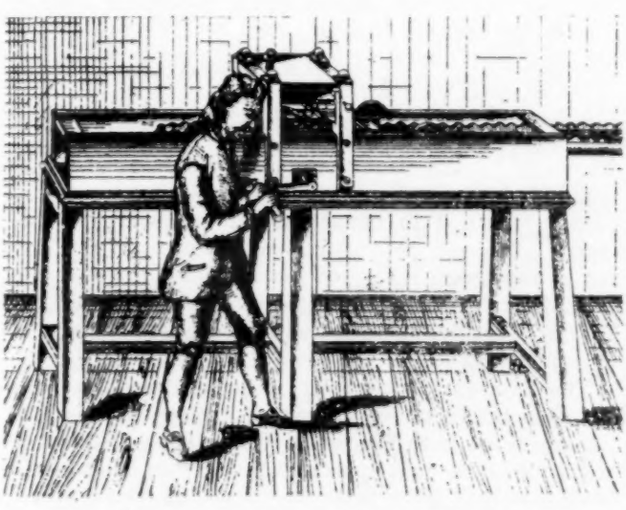


FIG. 64. DRESSING BALUSTERS IN THE U. S., 1775

The marshal of Massachusetts reported a manufacture of guns worth $229,085, without giving the number of the shops. Pennsylvania listed 115 gunsmiths and a production valued at $176,370. In this industry Virginia, Connecticut and the eastern district of Tennessee followed as named.

Pennsylvania had three boring mills, two saw factories, six wire works, 111 cutlers, four plane makers,

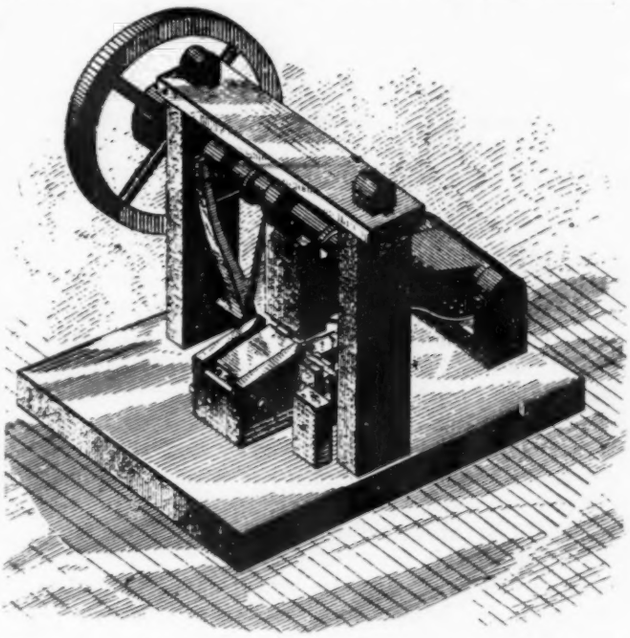


FIG. 65. A NAIL-CUTTING MACHINE IN THE U. S., 1810

one file factory, and two flatiron mills, while the marshals of the other states fail to mention these industries particularly. Pennsylvania and New Jersey each mention a wire-drawing mill. Massachusetts manufactured eleven million tacks with a value of $2,000. Door-lock factories were to be found in New Jersey and Virginia, and shops making augers in Virginia and Maine. There was one screw and spring factory in New Jersey.

Ordinary blacksmith shops were not enumerated by most of the marshals, but Pennsylvania was credited with 2,562, the value of the work done in which was estimated at $1,572,627.

There were also a number of factories dealing with copper, brass, tin and other metals or alloys. Massachusetts made products of this sort whose value was given as $225,160. Connecticut had four brass founders manufacturing $49,200 worth of ware. Rhode Island with one brass foundry produced 6,000 pounds of brass, the value of which then was $4,500. Brass clock and watch makers were mentioned in Virginia, Maryland, Vermont and Orleans, and no doubt clocks and watches were included in the brass wares produced in Connecticut. The tin plate work, which probably was for the most part merely tin smithing, was estimated as worth $139,370 in Connecticut, $91,500 in Maryland, and $73,715 in Massachusetts.

The last of the eighteenth and the first of the nineteenth century was a highly interesting period in the history of both wages and prices. It was the era of the French Revolution and Napoleonic wars, which created a great demand for both men and materials. In 1790 a skilled mechanic in the United States received about 54 cents a day, with which he could have purchased about three bushels of wheat for his week's work. At

the beginning of the century wages had reached a dollar a day with wheat fluctuating in accordance with shipping conditions, but perhaps averaging $1.25 a bushel. In 1812 wages were about $1.40 a day and wheat $1.94 a bushel. After the war wages declined to $1 a day and wheat to $1 a bushel, but the skilled mechanic could purchase twice as much for his week's work as in 1790.

Harmful Tendency in Trade Education

By B. A. Tibbab

Trade education, so far as public schools and education in general are concerned, is a comparatively new thing in education, and, like all new things, is adopted as proper by those who know and also by those who do not understand. Expense of equipment and operation have deterred some communities from entering this field, while others have spent with a too lavish hand in equipment and operation.

Between these two extremes are many and varied conditions. The question of expense of equipment and operation has been met in some places by expecting the shops to produce enough to help pay the operating expenses at least. From the business standpoint this seems perfectly feasible, yet, upon analysis, it is very much like the old, old question of serving two masters.

Let us consider it from the standpoint of the instructor: He is burdened with not only instruction and discipline, but is also charged with making a certain amount each year for the school support. Graduates are demanded, and machine product is expected. What will the poor teacher do when confronted by both demands? Which is slighted when pressure comes? Those in authority know immediately if mechanical output is reduced, though they cannot so readily note a drop in efficiency of a graduating class over that of the previous year.

Too many Boards of Education, in fact too many principals and instructors, place more emphasis upon the machine product than upon the boy. Many of those in authority do not realize that many times the boy is being sacrificed for the product, yet this is too true.

Have you ever visited the shops in your trade school? What is the boast of the instructor? What is that to which he points with the greatest pride? There are, of course, exceptions, but in many cases the photograph of the thirty speed lathes or the two hundred and fifty spindles for Blank & Co., or the hundred arbor presses being made for the Podunk Engineering Co. from their own castings and drawings, are the pride of the shop.

The harmful tendency of such work is not that it is unsuited to teach the desired principles of machine-shop practice, but rather the primary place this product has in the mind of the shop instructor and those in charge.

Here is the harmful tendency of our trade education. If we continue to place the emphasis upon the machine and the production of machines and exploit the student, then sooner or later the conditions will not be so far different from those in our factories.

In some of our schools the boy becomes as much of a producer, compared with the mechanical output of the plant, as does the boy in the factory. Is there any reason for this aside from the desire to produce a quantity of machines?

In the two hundred and fifty spindles for Blank & Co. referred to above, there is the cutting off, centering, facing, rough-turning, finish-turning, turning to shoulder, key-seating, grinding, and perhaps other operations, all of which may be given to different individuals and all of which may be divided among the class in such a way that all will receive the proper training.

Very few shops have more than one cylindrical grinding machine, which means that considerable planning must be done to give each boy some grinding. The two hundred and fifty spindles give a grand opportunity for just this training. Let each boy who has done enough elementary work to be fitted to take up the grinding machine have his turn at the job. When he becomes a producer so far as ability to handle the machine and do accurate work—from the school standpoint—in a reasonable length of time, the instructor should find something different for him to do in order that the boy may be always progressing, always learning, never being used to promote the shop or the instructor. The time for any boy to be changed from one machine or operation to another is when he becomes a producer. This should be the instructor's cue.

It has been my privilege to come in contact with many graduates from trade schools, first from the educational side and later from the position of the manufacturer. Boys have confessed to me that they have not had an opportunity to work upon all the varieties of machines found in the shop and had been kept upon one machine almost throughout their entire term of service. Only a few days ago, I had occasion to interview a young man who was in search of a position. I offered him a shaper job and he honestly told me that he was not able to do the work for he had never operated a shaper.

Inquiry brought out the fact that in nearly two years of work in a trade school he had not touched the shaper or planer, but had spent almost his entire time on a lathe. He had operated a milling machine some and had worked upon a drilling machine, but the major part of his time had been upon a lathe on turning jobs. He could do that work well, but I wanted a man and was willing to hire one even though he was not as experienced as the trade-school graduate was with the lathe.

The only reason that the boy could give for being kept on the lathe was that there seemed to be a lot of turning to do in the shop and he could do it faster and with less trouble to the instructor than other boys. The instructor may have had a good and sufficient reason for keeping the boy upon the turning job, but the statement certainly appeared to be an honest one from an apparently sincere boy.

I am not questioning the honesty and sincerity of any instructor, for, knowing these men as I have in the past, I know that there is a genuine endeavor to make their departments real, their work accurate and commercial, and to impart useful instruction to their classes. Noting the present tendencies, however, I cannot refrain from calling to the attention of those interested the necessity for keeping in mind the fact that the boy must not be neglected in order to make a profitable showing.

The boy must be the first consideration, but before the shop instructor can accomplish much in this direction we must have Boards of Education which will demand that their principals and instructors be something more than men with technical knowledge who have been successful in business management.

European Conditions as Affecting the American Machine-Tool Trade*

By Carl F. Dietz
Vice President, Norton Co., Worcester, Mass.

THERE are about as many opinions on industrial conditions in Europe as individuals expressing themselves thereon—even among those who had an opportunity to personally study the ground complete unity of thought is not found. It depends so very largely upon the manner of penetration, the industries visited, individuals interviewed and then on the proper analysis of this multiplicity of data.

As everywhere else in the world the demand for every commodity is beyond the ability of industries to furnish. Unlike ourselves, Europe is now mostly dependent upon imports—those imports coming largely from us.

The war left her pretty well paralyzed industrially, and only gradually will the situation right itself. Such wholesale disarrangement of industry, even omitting destruction, complete financial exhaustion and credit strain, to say nothing of morale collapse, cannot be overcome in one or two years.

Europe for the moment with the possible exception of England requires credit and requires it in very large doses. She cannot continue indefinitely to purchase more heavily than she sells, still further straining credit and depressing her currency values, without inevitably going bankrupt.

The result is that purchases from countries whose currencies are at a premium will be held down to bare necessities and the buying power directed toward the markets where advantages may be had; friend or late enemy—economic necessity will control, quite stripped of sentiment.

During the war relatively huge quantities of machine tools were shipped to England and France, some to Italy, many of which served gallantly in the production of needed war materials, but many also never saw service and with the others have since been either put to useful service in France and Belgium or cataloged and are being held for the reconstruction and needs of the destroyed industries in the war area.

Machines Ransacked by Germany Now Being Returned

When the Germans ransacked Belgium and France they did it thoroughly, not by any hit or miss method, but with a system that can leave no doubt as to their complete knowledge of the existence of every tool and its best possible service to them. Everything was ultimately either transported to Germany, or demolished, if of no direct military value. Now many of these tools are being returned—allied commissions spotting them throughout Germany and returning them whence they came.

We found one of our own grinders, one of the very early ones, machine No. 17, built in 1902, which was operated at the Bolinck plant in Brussels until June 1917, but after August 1914 by the invaders. It was then taken to Germany, set up and operated at a plant near Bonn, but now again through the activities of the allied commissions, has been returned to its original foundations and is merrily doing the same work as before the war.

This is true of many Belgian and French tools. In many cases they require considerable repairs, as in the case of this Bolinck machine. The tremendously high prices at present considered, it is economy to use as much of this material as can be salvaged until economic strength for replacement of antiquated equipment is gradually developed.

The impetus which the war has given to the machine tool industry will prompt many foreign machine tool builders to challenge the American product not only in their own countries but in foreign markets, even to a greater extent than ever before in our own domestic market.

English makers will not be content to let American products have the sway of pre-war days, but will try to meet the demand of her growing mass production industries, especially the automobile development. Through its machine-tool association, English builders will invade systematically and in force other markets worthy of development and capable of an adequate return.

Exchange Favors British

At the moment the rate of exchange favors British builders, and even if everything else were equal, the American tools are heavily handicapped with 20 per cent monetary shrinkage to carry. Wages in Great Britain have risen sharply, so that in some cases with the bonuses paid the average hourly rate is not materially different from our own, but in a large number of metal working plants the average is still a shade under 50 cents per hour (normal rate of exchange) for the whole shop force. On the other hand, it is freely admitted that the British worker does not produce as much as ours. In the automobile industry a prominent manager stated that he was actually equipping several large plants with 50 per cent larger machine-tool capacity for comparable production than he did in America.

There is in England at this time a very active demand for machine tools, and British manufacturers are indeed hard pressed to meet it. The long-drawn-out molders' strike of last winter in which 50,000 strikers for more than 20 weeks affected upwards of 300,000 shop workers, is in a measure responsible for the accumulated demand. This fact in spite of the handicap has prompted the placing of orders of no small consequence in the American market, and we still have the advantage of some special types of machines which, until the foreign builders have further developed their activity, will continue to come from here.

France and Belgium will with the gradual rebuilding of their industries continue to require machine tools, but a great deal must precede the placing of this equipment. They must first reconstruct their plants and then be sure of their raw material, coal for power, iron and steel to be worked with, also a more stable labor condition. Unless machine tools are not acquired

*Paper presented at the annual convention of the National Association of Machine Tool Builders, Atlantic City, N. J., May 20, 1920.

for the immediate production of wealth creating objects it would be folly for Belgium and France to place orders with us at the present high prices and with the dollar at the premium it commands. For example, a tool that in 1914 cost $2,000, equivalent roughly to 10,000 francs, today costs in America not less than $4,000 and at the present exchange rate 60,000 francs. So far as the French or Belgian buyer is concerned, to him the price has advanced sixfold. He naturally hesitates and seeks either to get along without new American equipment or turns his attention to other markets that may serve his purpose to better financial advantage.

Italy is in the same relative position and any of these countries can, provided delivery may be secured, buy to better advantage in England so long as the dollar pound sterling exchange shows 25 per cent depreciation.

Much has been said of the effect of German machine tools on the market outside of Germany. There appears to be a popular delusion that Germany is going to promptly step in and bid for the machine-tool demand of the world at what would be to us ruinous prices. Nothing can be further from the truth. To be sure, not long after the armistice, when the German marks went tobogganing, wonderful bargains resulted in buying such German tools as were available. So far as we were able to learn these were very promptly snapped up by the neutrals and to some extent by France, Belgium and Italy.

Average German Monthly Export

For a considerable period last year the average monthly outgo for export of German machine tools amounted to about 50,000,000 marks. This sounds very large, but when it is considered that the prices at which such tools were sold range from 12 to 17 times pre-war prices, it could after all not have been a very large tonnage. The German makers are crowded with orders, many of which they took at fixed prices, and then found themselves in the dilemma of not being able to get raw material, or, if they got it, at a price that would not admit of the transaction being carried through without a heavy loss to which was further added the extremely uncertain and constantly upward tendency of labor.

Contrary to all that has been said of the Germans going back with renewed energy, a willingness to work for the sake of retrieving their economic losses, we did not learn of a single instance where such a spirit was even remotely indicated. On the contrary, demands of the workers have gone to almost preposterous lengths, not so much from the standpoint of wage increase, which considering the increased cost of living is at least justified and probably still somewhat too low, but because of their attitude toward production as a whole. According to our conception of the word production, the broad statement can be made that they are not producing and adhere to the legal eight-hour day of slothful activity with a rigidity than can be called hardly anything else but stubbornness. Of course, in many cases raw materials are lacking, but even when these are available, instead of taking advantage of the opportunity to again make of themselves a producing nation along economic lines, they now prefer to spend their time in going on strike for petty reasons, and scheming out new ways for bringing about socialization of industry that in the end can spell nothing else but ruin, if not checked soon. Freedom in shop management according to any conception of industry's needs is almost wholly denied and the principal control of shop policies rests almost entirely in the shop council. According to the wording of this law it is supposed to operate for the benefit of employer and employee alike, but in practice it has resolved itself into nothing else but a bargaining committee usually antagonistic to everything excepting that which procures for the worker a larger measure of return without regard for what he gives in exchange.

Now a further step has been undertaken which is virtually a forced recognition of the union. If one quarter of the shop council, which by the way is chosen entirely without prejudice from any other source, by the workers themselves, elect to have a union delegate take part in any of its deliberation with the management, the latter has no choice but to recognize such delegate as a factor in his shop relations and, of course, the delegate dominates the situation. The only doubtful ameliorating provision is that the employer has the right to call in a member of the Employer's Association of the particular district in which he happens to be operating, presumably for moral support.

Living Costs and "Hand Outs"

To be sure, living costs generally, due to the breaking down of transportation systems, shortage of fuel and food products and clothing, has been driven upward to about fifteen times the pre-war basis and rates. In order to make up the difference the workers have from time to time in practically every industry demanded what can be termed nothing else but a "hand out" of so many hundreds or thousands of marks per person to cover the extraordinary living cost. In some cases wages are more or less regularly made retroactive, usually back to the time of the last wage increase agreement.

With such economic conditions and so distorted a national sense of economic needs, one cannot conceive of a German machine-tool manufacturer becoming much of a factor in the world's markets in the immediate future.

Financiers have recognized the altogether intolerable condition resulting from the currency depreciation and the far reaching demoralizing effects of exports to foreign countries on the mark basis. Some restrictions have already been imposed and many are under serious consideration. Even now most German machine-tool manufacturers are quoting on the basis of the currency of the country into which the products are to go and at a price in some cases slightly lower than that at which the same commodity can be purchased there irrespective of the market values at which these goods are sold in Germany itself. This is not unreasonable, since an income must be secured from all available sources.

Those who have placed orders for commodities in Germany are finding themselves either unable to get the product at any price or only at the prices for which the German manufacturer is willing to let the product go, when it is finally ready to ship.

No one could blame Belgium, France and Italy for buying products in Germany, in view of the advantage that can be taken of the exchange rate between their respective currencies and the mark. They are still financially better off than when purchases of similar commodities are made in England or the United States.

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Given a stable condition, a national sense of effort, raw material and transportation facilities, Germany could and would become a factor to be recognized, but with these attributes lacking she cannot be looked upon as a serious menace for some years to come.

During the period of complete isolation due to the war, German manufacturers made faithful copies of some of our well known American tools and are marketing them without regard for our origin of design. They will in due course try to invade other markets with these products, but after all we have not stood still and have gone far beyond the status of the machine-tool trade of five or six years ago. The newer developments making users less dependent on either the skill or personal interest of the worker cannot fail to command attention and respect that will result in a continuance and even further extension of our machine-tool industry, in foreign parts, even though for the moment foreign demand is at low ebb.

It is not only understandable but perhaps even gratifying that this demand is low. We all have more than we can do to take care of the home requirement and it is very much to be doubted that any of our prestige or respect for our tools is materially suffering in Europe because of this.

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There is a leveling process going on—never again will we see the disparity between wages here and abroad—the world has grown smaller as it were and in the various manufacturing countries in due course the same general fundamental conditions will prevail. Price will not be nearly so important a factor in the future trade relations. While this process of economic adjustment is going on and Europe begins to manufacture after her plants are re-established and raw materials are available, why not take advantage of the instrument happily made available through the Edge law. The means thus given us should be taken advantage of in the broadest possible way as a counter to similar foreign trade expansion by others, notably England. Beyond this have we not the ingenuity to continue the development of machine tools more than sufficient to counteract whatever handicaps there may be? We were able to do fairly well when merit had to fight price—can we not do even better when we force the foreign competitor to depend more upon merit than price, I think so, in fact am sure of it, and as a consequence can see no dark clouds on our foreign market horizon that are not lined—and heavily lined—with silver.

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The shop bulletin board is, in a certain sense, the heart of the shop. On this board appear all the notices which vitally affect the workmen, and on it is carried the message of inspiration which, when successful, fires the men with enthusiasm for the concern for which they work. But, too frequently, the bulletin board notices, which are intended to enthuse the workers, fail in this purpose and create distrust and sarcasm instead.

How can the bulletin board notices be made to function at 100 per cent in securing and holding the interest of the readers and in arousing the enthusiasm of the workers? One of the ways in which they can be made more successful in accomplishing such results is by the use of photographs instead of plain type to carry the desired messages. This is the age of visualization. People are accustomed to being shown by means of pictures instead of being forced to make mental pictures for themselves from the descriptions conveyed to them through the medium of type alone. Pictures nowadays have an immense hold on the public, as is attested by the popularity of motion pictures and the value of illustrations to magazines and papers. Consequently, when the shop bulletin board conveys its messages by means of photographs supplementary to the type, it is assuring for itself a wider reading and a deeper impression than would otherwise be the case.

For instance, suppose the shop has inaugurated a nursing service whereby any employee who has sickness in the family can secure the services of a nurse free of charge, and suppose that the men of the shop view the service with considerable skepticism, if not actual aversion. They feel that there is a catch in it somewhere and it can't be as good as it looks. It is right here that the bulletin board, by visualizing the nursing service through photographs, can entirely change the sentiment of the shop regarding the proposition. Suppose that instead of merely telling about the service in type the proposition is presented on the board by means of photographs. Let these photographs show the nurse in her costume and portray some of the duties she will perform in cases of sickness. Then, too, the steps necessary to securing the nurse's services can be shown in pictures, the first picture showing the man by the bedside of his sick child, the second showing him entering the shop superintendent's office to apply for the nursing service, the third showing him filling out the simple blank which will secure the service, and the fourth picture showing the nurse entering his home and the wife wearing a look of satisfaction. Wouldn't pictures like these be much more likely to catch and hold the attention of the shop worker than mere typo announcements?

Suppose, too, that a change in the method of paying the employees is inaugurated or that they are to be paid at different windows than formerly. Whenever anything of this kind is done there is invariably a vast amount of confusion, because the printed announcement of the change fails to convey the message understandably to a lot of the men. Suppose that the matter be presented by photographs also. Let the board show photographs of the buildings or departments from which the men would receive their pay at window *A*, and suppose that it presented a picture of this window and its location. Such a plan as this would make it mighty hard for the men to go wrong, and it would be like giving each man an individual guide to show him just where he must go for his envelope.

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A Few Splitdorf Details—I

By S. A. HAND and K. H. CONDIT
Associate and Managing Editors, *American Machinist*

An eminent physicist has said that in his opinion the ignition magneto ranks with the greatest achievements of electrical science. When one considers its performance under the most adverse conditions, that statement sounds reasonable. In this article we propose to describe briefly the operation of one type of magneto and begin the story of its manufacture.

BOTH battery and magneto ignition systems for internal-combustion engines can count their advocates by the thousand and consequently it seems safest to say that under certain conditions the first system will prove most commercially satisfactory, while under different ones the other will be the obvious choice.

In a paper read before the Society of Automotive Engineers some time ago, the author, Colonel Vincent, in describing the problems encountered in designing the Liberty motor, made the statement that at the time the design was started there was no magneto on the market capable of producing 12 sparks at the uneven rate required. The design was therefore made with battery ignition as a component part. He also stated that during the war several very good magnetos for this work had been developed.

One of these was the Splitdorf aircraft magneto, built by the Splitdorf Electrical Co., of Newark, N. J. It was simply a modified form of their standard aëro type, designed to give sparks at intervals of 45 and 75 deg. as demanded by the 12-cylinder Liberty. There are magnetos and magnetos and they differ greatly in minor points and even in electrical principle.

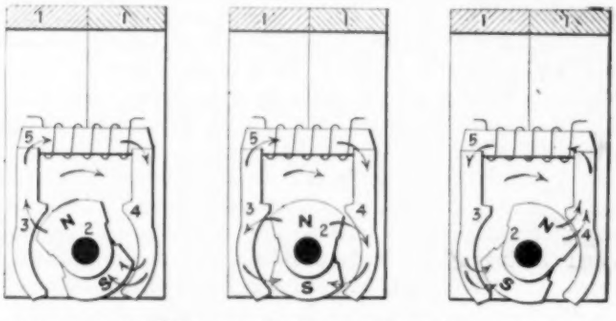


FIG. 1. MAGNETIC DIAGRAM OF SPLITDORF MAGNETO

The Mason principle is not new, as magnetos of this type have been made for some years, but it is so different from that of the usual run that it will be given here. The basic principles being the same for all models it will be simpler to take the four-cylinder type and work with that only. This magneto is what is known as the true high-tension type, electric current at a sufficient pressure to jump the gap between the spark plug point under the pressure existing in the engine cylinder being generated in the instrument itself without the use of any outside coils or other supplementary devices.

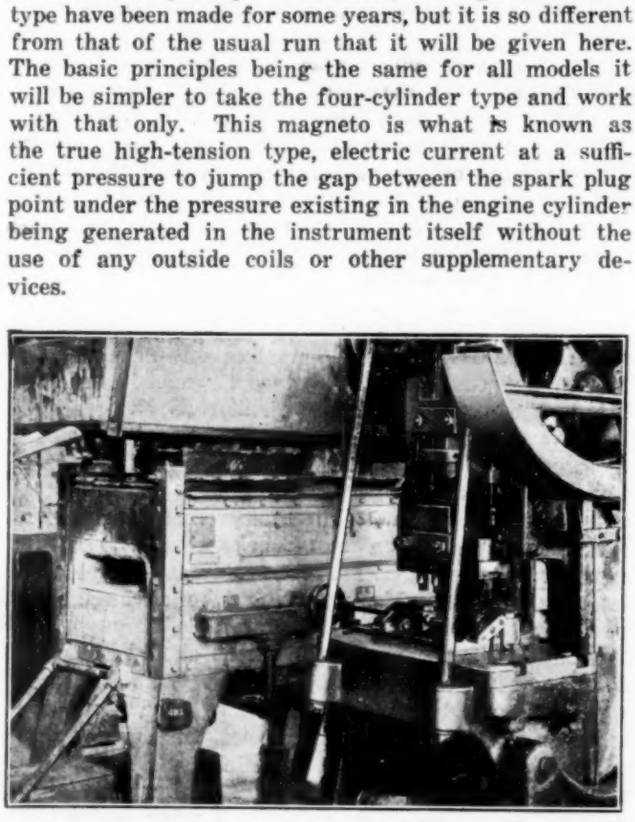


FIG. 2. MAGNET-HEATING FURNACE AND PUNCH PRESS

The ordinary high-tension magneto is practically a dynamo-electric machine run as a generator. Permanent magnets are used instead of electro-magnets and there are two windings on the armature, the primary winding consisting of a few turns of relatively heavy wire and the secondary winding consisting of a very large number of turns of fine wire. Rotation of the armature by mechanical means within the magnetic field set up by the permanent magnets results in the generation of an electric current of low voltage in the primary winding. Interruption of this current when it reaches its maximum value causes a sudden reversal of the magnetic lines in the soft-iron core on which the coils are wound and induces a very high voltage current

AUTOMOTIVE CONSTRUCTION

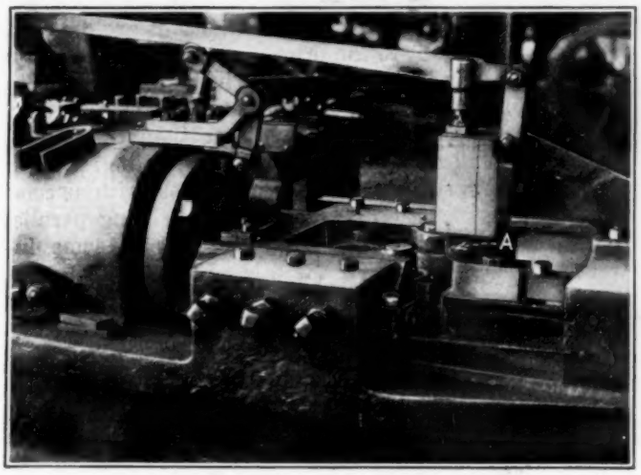


FIG. 3. BENDING MAGNETS IN A BULLDOZER

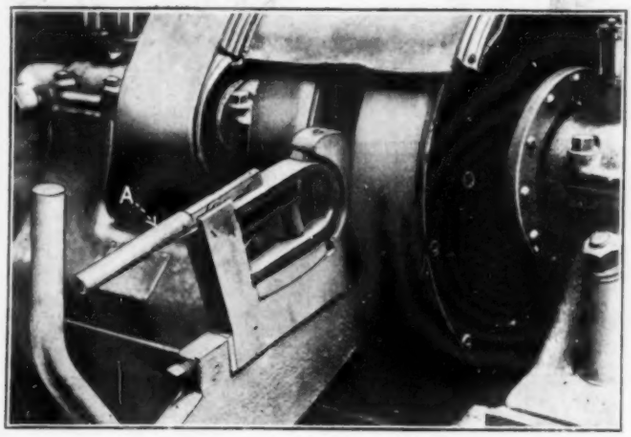


FIG. 5. FINISH-GRINDING THE SIDES

in the secondary winding which is sent to the proper spark plug by the distributor and high-tension wire.

This is only a bare outline of what actually takes place, but it will probably be sufficient to bring out the difference between the two systems. In the Splitdorf type the rotor, instead of having the two coils wound upon it, carries four malleable-iron wings, insulated from each other by a brass section, two always adjacent to the north magnetic pole and clearing it by a very small amount and the others occupying a similar position with respect to the south magnetic pole. Instead of the magnets being parallel to the rotor axis so that the lines of force flow at right angles to the axis, they are placed at 90 deg. from this position so that the ends of the shaft project through holes in the magnets. The coils are wound on a laminated iron core, the location and shape of which are indicated in Fig. 1. Extensions of the core form pole shoes through which the magnetic lines travel as shown by diagram in Fig. 1.

It will be seen that this method does away with rotating coils and simplifies the construction of the rotor to a considerable extent. As in the other type the interruption will break the primary circuit when the current is at its maximum, or when the left-hand corner of the wing *N* leaves the upper corner of the pole shoe, and again 180 deg. later.

Reduced to its simplest terms, the difference between the two systems is that in the armature type the coil rotates within the magnetic field, reversing twice per revolution, while in the Aëro type the coil is stationary and the direction of the lines reverses four times per revolution, thus producing the greater electrical efficiency.

Probably the most difficult part of a magneto to manufacture and the part upon which the successful operation is most dependent is the magnet. It is not sufficient to get good magnets part of the time; they must all be good and they must stand up, or the instrument soon gets a bad name.

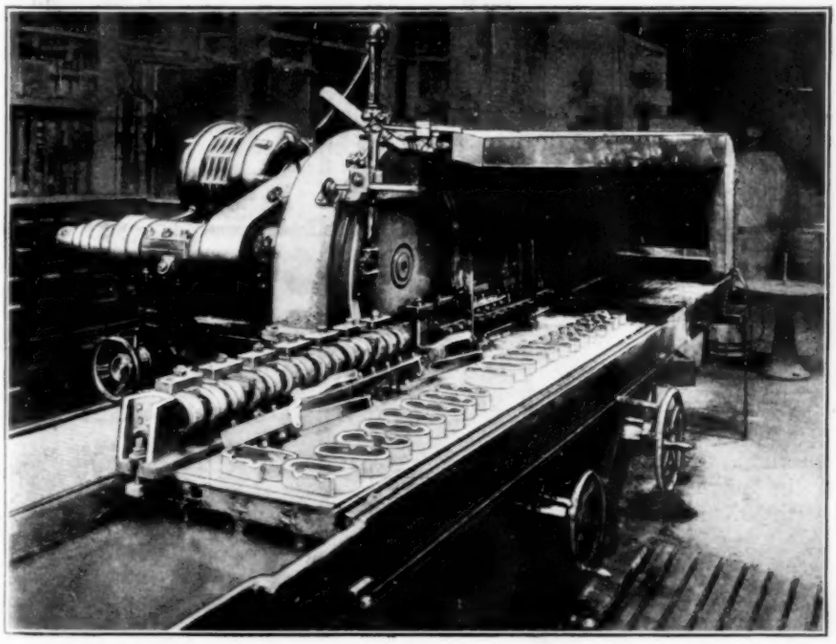


FIG. 4. END-GRINDING IN A DIAMOND MACHINE

Manufacture of the Magnets

The magnets are sheared cold to the proper length from chromium-steel stock. The strips are then heated in the automatically fed, gas-fired muffle furnace shown in Fig. 2 at the left. Passage through this furnace takes about 40 min. and the temperature is controlled by an automatic electric pyrometer.

As the magnets, when finished, are used in pairs set side by side, it is necessary that clearance for the rotor shaft and other parts be provided. This is done by punching in the press shown at the right in Fig. 2, where semicircular pieces are cut from the sides of the magnet bar so that when put together the clearances will form a round opening. From the punching machine the bars are slid down an inclined chute to the bulldozer shown in

AUTOMOTIVE CONSTRUCTION

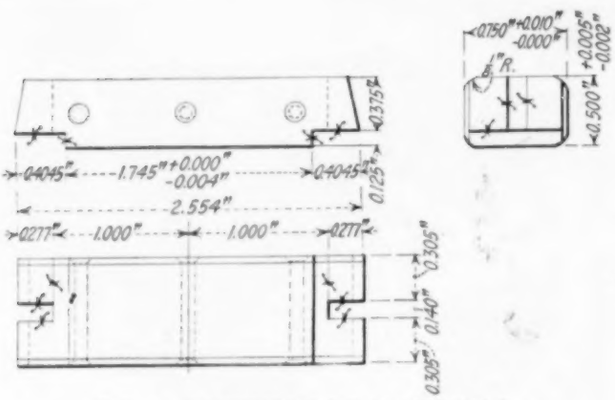


FIG. 6. LAMINATED CORE ASSEMBLY

Fig. 3. Here they are bent to the customary U-shape. No reheating is necessary as the bars are handled so quickly in punching and in their delivery to the bull-dozer as to retain enough of their heat for the bending operation. As may be seen in the illustration, the movable die is equipped with rollers for the bending, during which any tendency for the bar to creep or crawl is prevented by the sharp-edged roller *A* which bites into it at the central part of the curve. This roller is automatically brought into contact with the work as the movable die advances and released in the same manner as it recedes. The method of operation will be easily understood by examination of the levers and connections as shown in the illustration.

As the bending leaves the legs of the U of somewhat uneven length and also rounds the edges at the bend, it is necessary to grind both the ends and sides of the magnet. The ends are ground on a heavy Diamond face-grinding machine, as shown in Fig. 4, where a long string of magnets held in fixtures may be seen upon the table.

Grinding the sides is a rough-grinding operation and is done singly between two disks on a Besly disk-grinding machine, as shown in Fig. 5. In this operation the work is held in the fixture by pressure of the operator's hand on the lever *A* so that no time is lost in manipulating clamps.

After grinding, the magnets are heated to 1525 deg. F. in a Frankfort furnace and quenched in oil and are then taken to the magnetizing table. There is nothing special in the operation of magnetizing, though it may be noted that the amount of magnetic force is indicated on a translucent scale by a beam of light reflected from a mirror attached to the pivot of a galvanometer needle.

As the magnets when assembled must be in close magnetic contact, their contacting faces must be practically plane and for this purpose these surfaces are ground on a Blanchard rotary grinding machine. Here they are grouped and closely nested on the magnetic table of the machine which can be loaded with 338 pieces at one time.

The Core Structure

One of the characteristic features of the Aëro magneto, as mentioned before, is the laminated core structure upon which the coils are wound. The core assembly appears in Fig. 6. The laminations are punched from iron strips slit to the proper width. An automatic punch press is used for this job. The blanks then go to the assembling bench where they are staked together. The outside pieces, which are thicker than the others, are countersunk for the rivet heads. With the rivets in place the core is squared up in a press with special dies, the line of action of the press ram being parallel to the laminations. This usually results in some increase in the thickness of the pile of laminations, so a succeeding press operation flattens them to size within 0.010 in., after which they are squared up again. They are then annealed and brushed, ground, milled and slotted.

Finally they are impregnated with varnish.

Except for the squaring operations the laminated pole pieces which form extensions of the core receive the same treatment as that already described. Both these parts are made of soft iron to offer an easy path for the rapidly changing lines of magnetic force.

Device for Fitting Pistons

By J. H. Vincent

In a large gas-engine factory the pistons are fitted individually to the cylinders in which they will be assembled. The assembler slips different pistons into each bore and tries their fit until he finds one that is correct and the device shown in the illustration is the tool he uses to expedite the insertion and withdrawal of the pistons.

It consists of two flat bars with round bosses on their lower ends which are sprung into the wrist-pin holes from the inside and are held in position by the center spring. The upper ends are joined together by the handle which the assembler holds in one hand as he slides the piston up and down in the bore while feeling its fit.

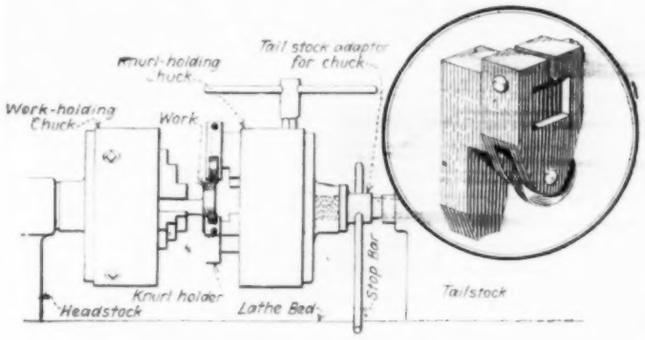
DEVICE FOR FITTING PISTONS

Using the Lathe Chuck as a Knurl Holder

By H. H. Parker

This addition to the different knurl holders previously described consists of three holders attached to the jaws of a universal chuck. The holders are made from blocks of cold-rolled steel and should be exactly alike.

The chuck preferably should be stationary in order to make it easier to adjust to the work and is shown held in the tailstock by an adapter that has a screw on



THE KNURL HOLDERS

the outer end the same as the nose of the head spindle, while the other end is tapered to fit the tail spindle. The hub is drilled and a rod put through it which rests against the lathe bed and prevents the chuck from rotating.

The work to be knurled is held in another chuck or by other suitable means and rotated at a proper speed for knurling. Pressure is applied to the work by means of the chuck wrench.

Setting the Milling Machine Vise in Alignment

By Charles D. Folsom, Jr.

The operation of setting a milling-machine vise in alignment has been discussed in the *American Machinist*, Vol. 52, by four different men, each of whom had a different opinion as to how it should be done. Mr. Grill started the ball rolling by telling on page 356 how to use a micrometer clamped on the arbor of the machine, taking readings against a parallel strip held in the vise. Mr. Cunau, on page 589 in a later issue, agrees, but claims that a dial indicator is better than a micrometer for this purpose, which, of course, is quite true and obvious—provided you have the indicator. Both of these gentlemen, however, were a little off the track, as is pointed out by Mr. Raught on page 556, where he straightens the matter out nicely. But then Mr. Hanneman, on page 846, comes along and gets it tangled up again. I note that Mr. Hanneman begins his article with these words: "Referring to the method of setting a milling-machine vise parallel with the *cutter*, described by John A. Grill . . . ." Now Mr. Grill's words were: "A good way to set a milling-machine vise square with, or parallel to the *table* . . . ." I assume, however, that Mr. Hanneman refers to parallelism with the table, because that is the usual requirement. His method is to put an indicator on the arbor contacting with a square in the vise, and turn the spindle instead of traversing the table. In that case h would be setting the vise jaw square, not with the table, but with the spindle of the milling machine, and in an old machine he would find that would make a lot of difference.

Your readers at this point will probably think I have conglomerated the hypothesis hopelessly, but the operation in question is really a simple one. It requires no skill, no calculating, just common sense and a knowledge of what you want—that is the important part. As an

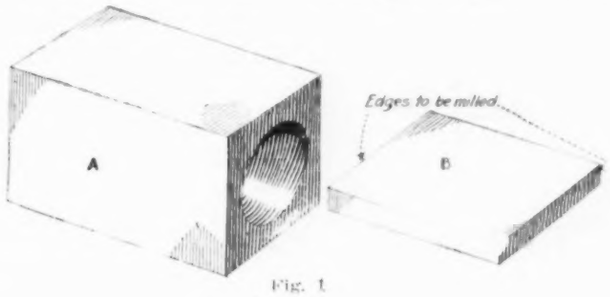


Fig. 1

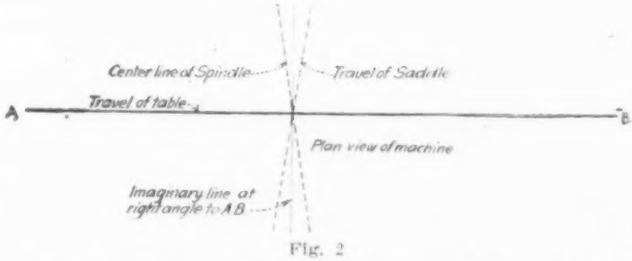


Fig. 2

FIG. 1. TWO TYPES OF MILLING-MACHINE JOBS. FIG. 2. FACTORS TO BE CONSIDERED IN ALIGNING WORK ON A MILLING MACHINE

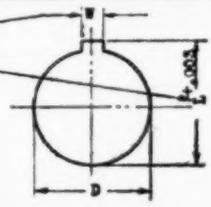
illustration, take the pieces shown in Fig. 1. Let us say that the hole in *A* must be bored through it parallel to the sides and that two parallel edges of *B* must be milled square with the two previously machined edges. Would the same method of setting the vise do for these two jobs? With a new machine it probably would, depending on the accuracy required; with an old machine it probably would not. In the case of *A*, you should move the cross-slide, or saddle, in and out with the indicator against the vise jaw; you would then be setting the jaw parallel with the travel of the cross-slide. In the case of *B*, you should move the table in a longitudinal direction, with the indicator against the blade of a square held in the vise. You would then be setting the jaw square with the travel of the table. In both cases you would be avoiding, rather than including, errors in the machine slides.

If this seems to be splitting hairs too fine, don't fool around with an indicator at all; use blocks in slots in the bottom of the vise. If these are not available, hold a square against the column of the machine and line up the jaw directly with the blade; or, for setting the vise parallel with the table, use a surface gage with "gage pins" against the edge of the table. But, if you are going to use an indicator, which can be made to give very accurate results, give it half a chance to do its work right. The diagrammatic sketch, Fig. 2, shows some possible errors in a milling machine upon which this discussion is based. The center line of the spindle need seldom be considered, probably only when using a star feed or other facing attachment.

Those to whom this is not yet altogether clear would do well to look over the article on "Testing Methods Employed at the Becker Milling Machine Co.'s Plant," in the April 15 issue of the *American Machinist*.

Title. KEYS | STANDARD DATA FOR ENGINEERING DEPARTMENT. | DRN. | CKD. | APD.

Dimensions of keyways in hubs to be shown thus:



To calculate the dimension L the following formula should be used: $L = \sqrt{\left(\frac{D}{2}\right)^2 - \left(\frac{W}{2}\right)^2} + \frac{W}{2} + \frac{D}{2} + .005$

A tolerance of +.003 should be allowed.

DIMENSION—L—IN INCHES.

Width of keyz W	1/16	3/32	1/8	5/32	3/16	7/32	1/4	5/16	3/8	7/16	1/2	9/16	5/8
No. of Std. Woodruff Key	1	2,4	3,5,7	6,8,10	9,11,13 16,19,26	12, 14, 17, 20	A,5,16,21 C,24,27	B,D,25,28,S	E,F, G, 29,T,30	U, 31	V 32	33	34
5/16	.348												
3/8	.409	.430											
7/16	.480	.488											
1/2	.516	.548	.559										
9/16		.592	.602										
5/8		.673	.686	.698									
11/16		.737	.749	.762									
3/4		.799	.813	.823	.846								
13/16			.875	.887	.908								
7/8			.938	.950	.965	.978							
15/16			1.001	1.014	1.027	1.039							
1				1.077	1.090	1.102	1.116						
1-1/16				1.139	1.153	1.166	1.179						
1-1/8				1.202	1.215	1.229	1.242						
1-3/16				1.264	1.279	1.292	1.305						
1-1/4					1.342	1.354	1.367	1.381					
1-5/16					1.404	1.417	1.430	1.444					
1-3/8					1.468	1.481	1.495	1.519					
1-7/16					1.530	1.543	1.557	1.585					
1-1/2						1.606	1.620	1.648	1.669				
1-9/16						1.669	1.683	1.707	1.732				
1-5/8						1.733	1.745	1.772	1.794				
1-11/16						1.796	1.809	1.834	1.858				
1-3/4						1.857	1.871	1.897	1.921	1.944			
1-13/16							1.933	1.960	1.985	2.008			
1-7/8							1.996	2.022	2.045	2.069			
1-15/16							2.060	2.085	2.112	2.137			
2							2.122	2.149	2.176	2.200	2.223		
2-1/4							2.368	2.401	2.427	2.453	2.477	2.500	
2-1/2							2.623	2.652	2.678	2.705	2.729	2.753	2.776
3									3.180	3.205	3.234	3.263	3.285

Dimensions within heavy lines are for the correct Woodruff keys for use with various shaft diameters

TABLE SHOWING DIMENSIONS OF INTERNAL KEYWAYS

Dimensioning of Keyways

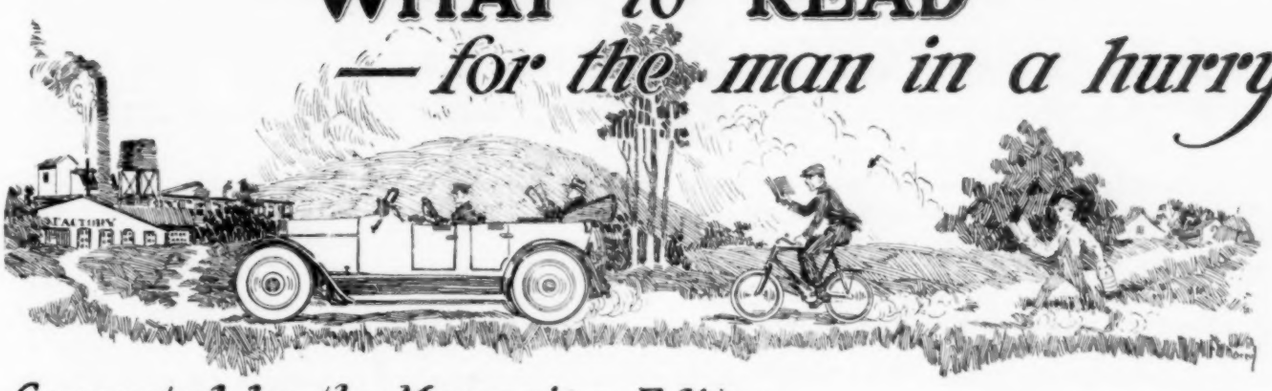
BY HANS ERNST

It is generally conceded that the most satisfactory way of dimensioning keyways in hubs of pulleys, etc., is to give the dimension from the bottom of the keyway to the opposite side of the hole, as shown at *L* in the accompanying diagram; yet this is seldom done owing to the extra work it entails on the part of the draftsman. To avoid the necessity of calculating this dimension each time it is required, the accompanying table was drawn up and incorporated in the book of standard data for use in the drafting room, each draftsman being furnished with a copy. This table gives the value of dimension *L* for every practical combination of keyway and shaft up to 3 in. in diameter.

To find the dimension, for example, with a shaft 1 in. in diameter and a keyway $\frac{3}{8}$ in. wide, follow along horizontally opposite 1 in. and in the vertical column under $\frac{3}{8}$ in. will be found 1.102 in., which is the value of the dimension *L*. In every case an allowance of 0.005 in. has been made to insure that the key will not fit on the top. The dimensions within the heavy lines indicate the sizes of standard Woodruff keys recommended for use with the corresponding shaft diameters.

The various numbers of standard Woodruff keys shown in the second horizontal row have the same widths as the dimensions directly over them, thus eliminating the use of a separate table.

WHAT *to* READ
—for the man in a hurry



Suggested by the Managing Editor

What to read was not a difficult matter to decide two hundred years ago when books were few and magazines unheard of. It is far different now when so much reading matter is offered to pass the time pleasantly or profitably as the reader chooses. We are doing our utmost to make the "American Machinist" not only profitable but indispensable as a clearing house of ideas and news of the machinery world. This page is the editors' advertisement of their section of the paper. It gives the high spots.

ACCURATE physical measurement is becoming more of a practical shop process and less of a theoretical laboratory problem every day. With this change has come the standard gage and with it the necessity for some accurate means of checking the standard itself. A Swiss instrument for this purpose has just been introduced in this country and is described in detail in our leading article this week. It is the product of the Société Genevoise d'Instruments de Physique (thank Heaven we can write that out and don't have to say it over the telephone!). It will be worth while to compare its construction and principles of operation with those of some of our own machines that are designed for precise measuring.

The various machines employing the oxy-acetylene flame for cutting metals are taken up in Part XXIII of Ethan Viall's welding series beginning on page 54. Both foreign and American machines are described in portable as well as fixed types. The savings in time and expense made possible by these cutting machines are so remarkable that it behooves every engineer and shop man to be familiar with their possibilities.

On page 63 we have the conclusion of Part VII of Basset's Modern Production Methods. This installment takes up machine scheduling, stock-delivery requirements and machine load records. Their relation to modern production planning and shop control is brought out clearly.

Part X of H. H. Manchester's historical series on the evolution of the modern workshop starts on page 71. The last installment wound up the articles dealing with the industry in Europe and this one shifts to America and traces the early attempts at manufacturing in the English Colonies. Eli Whitney's pioneer attempt at interchangeable parts manufacture is mentioned and the records of the United States marshalls for the 1810 census are discussed as giving the best indication of the growth of the industry in the new republic.

Reports on conditions abroad as we get them from the daily press are so confusing and at times utterly contradictory that we are glad to be able to publish a statement from a man who has just come back from the seat of the disturbance. In this issue we have a paper presented by Carl F. Dietz, vice president of the Norton Co., before the annual convention of the National Association of Machine Tool Builders at Atlantic City late in May. Mr. Dietz's picture of German labor troubles and the ability of German manufacturers to flood the market with cheap products is rather different from some we have seen. "Contrary to all that has been said of the Germans going back with renewed energy and willingness to work for the sake of retrieving their economic losses, we did not learn of a single instance where such a spirit was even remotely indicated." A very positive statement and one that is rather disquieting to the student of world affairs, but comforting to the competitors of those German shops.

Mr. Dietz is optimistic regarding the future of our foreign markets for machinery, but he warns us of the strength of the British association of machine-tool builders and urges the fullest use of the provisions of the Edge law which permit associations of manufacturers and merchants for foreign trading. In this connection we want to call your attention to a very similar statement concerning the British competition in foreign trade made by Frederick Palmer, the famous war correspondent, in his address before the summer meeting of the Society of Automotive Engineers on Lake Michigan. See page 84. This matter is a serious one and merits immediate consideration.

General shop articles by Frank A. Stanley, Herman L. Wittstein and two members of the staff appear on pages 61, 67 and 78.

Another one of our London correspondent's informal accounts of British affairs appears on page 91. Mr. Chubb, who writes these letters, is well fitted to give an accurate picture of English shops and markets because of his wide acquaintance among the island machinery men. We follow up his general letter with two of his accounts of local conditions in Halifax and Birmingham which appeared in our European edition.

Summer S.A.E. Meeting

THE dates June 21 to 25 will go down in history in red letters as the occasion of the biggest summer meeting of the Society of Automotive Engineers ever held. There will undoubtedly be bigger ones in the future but never a more enjoyable one. Last year's session at Ottawa Beach, Mich., was so successful that the meetings committee decided to stage a comeback and their decision met with widespread approval among the members.

Five days of perfect weather added much to the success of the occasion the only drawback being the temperature which stayed too low to make bathing an unmixed delight. The members arrived by train, by boat and by automobile to the number of about eight hundred and taxed the capacity of the four hotels on the bay, which had been chartered for the meeting. A few were expected by airplane but for some reason failed to put in an appearance.

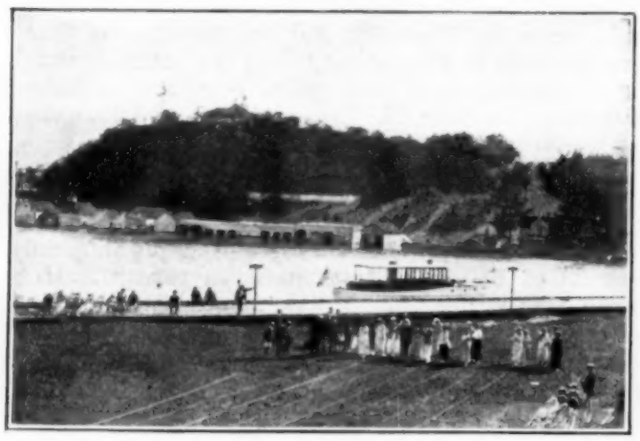
As usual, the meeting was opened by the sessions of the Standards Committee and reports were received from the divisions on Aeronautics, Automobile Lighting, Electrical Equipment, Electric Transportation, Engine, Iron and Steel, Miscellaneous, Motorcycle, Roller Chain, Shaft Fittings, Springs, Tire and Rim, Tractor and Transmissions. Due to the lateness of the New York Special, which brought the Metropolitan Section, the Standards meeting was continued in the afternoon. The first rounds of the tennis tournaments were started on Monday afternoon as well as the qualifying round in the golf tournament.

After dinner the semi-annual business meeting was held and the usual reports and addresses were passed on and listened to. Col. J. G. Vincent, president of the society, took up in detail the three great problems which are now facing the automotive industry, the discriminatory attitude which the bankers are assuming toward automobile manufacturers in the course of the general restriction of credit decided on by the Federal Reserve Board to put the country on a sounder financial basis; the construction and maintenance of improved highways to carry the ever-increasing motor traffic of the country; and the growing seriousness of the rapidly-diminishing fuel reserve. He closed with a summary of the air craft situation in which he stated. "* * * I will venture the prediction that the time is not far off when we will see a plane equipped with a 180- or 200-hp. engine, capable of carrying 10 passengers at a speed of more than 100 miles per hour with a fuel economy of eight miles to the gallon or better. * * * The only complete answer to this problem, as I see it, is to develop commercial aeronautics, and it is largely up to us engineers to bring this about, partly by engineering and partly by a united educational campaign. * * * The United States positively will not be in a safe position until this result has been accomplished."

The business meeting also took final action on the amendments to the contsitution proposed six months previously. At the request of Vice President Wall, who stated the conclusions arrived at by the council, most of the amendments were voted down. The only changes resulting from the whole agitation were those making the dues of junior members ten dollars instead of five and making the ages of automatic increase from junior to senior rating 30 instead of 26.

A short discussion of the merits of the metric system followed, several members with electrical training advocating its adoption. A motion to place the society on record as being against the compulsory adoption of the metric system was loudly seconded by half the men in the room and carried unanimously. Several members asked to be put on record as favoring the ultimate gradual adoption of the system although they were against compulsion in the matter.

The first professional session opened at 10 o'clock Tuesday morning with Henry M. Crane in the chair. This meeting was designated as a fuel session and papers on Carburetion and Distribution of Low-Grade Fuel and The Fuel Problem, from the Refiner's Viewpoint, were presented by O. H. Ensign and R. L. Welch respectively. A symposium on engine design was presented by Messrs. H. M. Crane, C. A. Norman, W. E. Leigh, and P. S. Tice. The report of the Automotive Fuel Committee was presented by the chairman, H. L. Horning. Animated discussion followed the presentation of



BLACK LAKE AND THE SAND DUNES

THE PRINCIPAL CENTER OF INTEREST

THE NEW 2½-TON TRACTOR

each paper and resulted in the postponement of the paper by W. S. James of the Bureau of Standards on "Intake Manifold Temperature and Fuel Economy" until the following afternoon.

Mr. Welch, who is general secretary of the Petroleum Institute, made the presentation of his paper rather brief and then devoted more than one hour to answering more or less pointed questions from the floor. He made it very clear that the country, at the present time, is consuming the various fuels refined from petroleum at a rate exceeding the production, and he urged the fullest co-operation on the part of the automotive industry to obtain a solution of this critical problem. Among other things, he suggested the inefficiency of using high-powered multi-cylindered cars for use in the overcrowded city streets.

THE SELF-PROPELLED 75-MM. GUN MOUNT

Tuesday afternoon saw a continuation of the baseball championship series and of several rounds of the golf and tennis championships.

At eight o'clock that evening, Col. Frederick Palmer, dean of the American War Correspondents, gave a very interesting talk on conditions in Europe at the present time. As Mr. Palmer has just returned from six years on the other side he was well fitted to give an accurate picture of the situation.

Mr. Palmer brought out very clearly the workings of England's superb organization to secure world trade. He told of the close co-operation of the British Diplomatic Service with the British merchants and manufacturers and gave some instances to show how well prepared they are to start trade with Central Europe. He urged the importance of some form of League of Nations for the preservation of the smaller European nations, particularly the new ones formed by the Peace Conference.

Colonel Palmer painted a dark picture of the economic and social conditions in some countries but expressed his opinion that the near future would show a complete recovery and the restoration of normal conditions.

The Wednesday morning session was devoted to transportation problems and was presided over by Colonel Vincent. G. A. Green presented a paper on "Motor Bus Transportation," Col. B. F. Miller, M. T. C., U. S. A., one on "The Relation of the Motor Transport Corps to Commercial Transportation," and Col. E. S. Gorrell one on "Air Navigation."

The proposed program of the S. A. E. Committee on the Science of Truck Operation was discussed by the chairman, F. W. Davis. Sec. H. G. Shirley of the Federal Highway Council gave the road builder's point on the problem of perpetuation of our highway system.

"Some Inland Waterway Transportation Problems" were discussed by Carl J. Baer of the St. Louis Chamber of Commerce and B. E. Lacey.

Promptly at 2 o'clock Wednesday afternoon the big program of field sports was started by the official announcer, Harry Knepper, and his staff of judges and timers. Instead of resorting to handicaps the committee in charge divided the contestants into classes according to age and weight with the result that the competition in most of the events was very close. According to the announcer remarkably fast time was made in the fat men's race, a record of 5 seconds for 50 yards on the grass being hung up. Even more remarkable was the speed of the winner of the stout ladies' 30-yard dash, who covered the distance in 4½ seconds. This was the figure given by the announcer and is presumably official, although the correspondent had no stop watch and consequently has some little hesitancy about vouching for the honesty of the timers in this event. High and broad jumps and the shot-put were also closely contested and baseball throwing for the ladies brought out some remarkable talent.

The Wednesday evening lecture was delivered by Major Thurman H. Bane, head of the Technical Section of the Army Air Service, and covered the work done at McCook Field by his division since the Armistice. He showed slides of the new engines and planes

SELF-PROPELLED MOUNT FOR 155-MM. GUN

which have been and are being developed and followed this with "movies" showing parachute jumps and the action of the new planes in the air. The Army's entrant for the Gordon-Bennett cup attracted some attention as did the armored triplane developed for use near the ground against enemy troops. This machine mounts four Lewis guns in a row, pointing downward, and Major Bane stated that its effect on the field is very much like that of a plow.

A new 18-cylinder Liberty engine was shown and also a large and a small 12-cylinder aircraft engine being built by the Packard Co. for the Army. There were also slides of English and American air-cooled fixed radial engines for use in smaller planes.

The morning session on Thursday was devoted to the discussion of "Power Farming." E. A. Johnston was charman of this session and papers were presented by O. B. Zimmerman on "Analysis of Fundamental Factors Affecting Tractor Design;" by Percival White on "The Operating Speeds of Agricultural Implements," and R. W. Lohman on "Power Farming."

The sports program was concluded in the afternoon with the finals in the golf and tennis tournaments and with water sports. The latter included swimming and diving and canoe racing and tilting. In the canoe tilting one of the contestants performed a rather unusual feat by falling into the opponent's canoe without upsetting it or his own.

Earlier in the afternoon the Army Ordnance Department staged a demonstration of three new Army tractors. The smallest one was the new 2½-ton tractor which is notable for its highly developed control. When this machine is in action on smooth ground it turns and twists with a rapidity which reminds one of a water bug. Not the kind that lives in city apartments, but the variety that travels around on top of the water in country brooks and pools. This tractor hau'ed a 3-in. gun and limber through the cellar of a burned down house and through a swamp and brook two feet deep with the utmost ease.

The other small tractor mounted a 75-mm. gun and was designed for work in wet country. The Cadillac engine is fitted with a long vertical intake which permits it to be run completely submerged with only the top of this pipe and the driver's head above water. In the demonstration the driver evidently preferred to stay dry but he proved to every one's satisfaction the ability of this self-propelled gun mount to travel in four feet of water as easily as on dry land. A tug-of-war between these two smaller tractors wound up their exhibit and resulted in two very deep holes in the sand of the beach where the contest was staged. The 2½-ton tractor finally pulled the amphibious gun mount back six inches and was declared the official winner.

A larger gun mount of distinctly different type and with great possibilities was also demonstrated. This machine was designed by Walter Christie, and includes features which are entirely new. It mounts a French 155-mm. G. P. F. gun and weighs only 22 tons as compared with the usual 30 to 40 tons for this type of vehicle. The caterpillar track instead of running on the usual small steel wheels is carried on disk wheels mounting solid rubber tires about 3 ft. in diameter. There are four of these wheels on each side of the tractor. A 6-cylinder engine gives this truck a possible speed of 12 miles an hour in soft going.

The most interesting feature is the ability of the machine to run 20 miles an hour on hard roads on its rubber tires with the caterpillar tracks removed. A trained crew can remove these in three minutes and replace them in five. Their removal automatically connects the steering gear which is used when the machine runs of its wheels. Some snap shots of these trucks in action are shown in these pages.

Another exhibit of more than passing interest was that of the Goodyear Co. It was their new heavy-duty pneumatic tire truck which has two rear axles in tandem and consequently runs on six wheels instead of four. This machine was used throughout the week to transport the members from the dock to a farm where demonstrations of tractors and farming implements were carried on every afternoon.

The grand ball and dancing contest were held Thursday evening and marked the climax of the meeting.

On Friday morning the professional session devoted to production was held and the most interesting paper of the whole meeting was presented by A. F. Knobloch of the Cleveland Tractor Co. In this paper Mr. Knobloch discussed the importance of the human element in manufacturing and gave some almost unbelievable figures of increased production per man resulting from a careful study of this element. Other papers presented were on "Production Control, and Systems of Accounting," by A. G. Drefs, and "Inter-departmental Production Contests," by R. R. Potter.

Old Baldy Would Have Murdered This One

BY CHARLES D. FOLSOM, JR.

Mr. Remacle's story on page 1154, Vol. 52 of *American Machinist* reminded me of another example of "Cá Canny tactics" that I saw some time ago, that would have made "Old Baldy" see red. The man in this case was a milling-machine hand—he really was—when he felt like it; but on this occasion he did not feel like it.

His job was to mill some brass castings with a surface about 2 x 5 in., with about ⅛ in. to come off. The machine was a vertical, and the cutter was a 5-in. face mill.

Well, he put on the fastest speed and the slowest feed and piled right into it. It looked as though he was going to kill the job. But not only was he fast, he was very accurate. In order to be sure to hold within the limits (+.01 or so) he felt it necessary to let the cutter run entirely across and off the work, and then instead of resorting to the back-breaking process of returning the table by hand, he reversed and let it feed back.

Sometimes on this return cut, for the sake of variety, he would raise the cutter about an eighth of an inch above the work; in that case he placed a piece of cardboard in front of the cutter, ostensibly to prevent chips from flying around, but possibly also to keep prying eyes from discovering his unique method of securing extreme accuracy.

Later on I had occasion to do the same job myself, and just for fun I did a little figuring. I found that our friend had used a cutting (sometimes) speed of 223 ft. per minute, and a feed of 1.4 inches.

Now if this incident had occurred in "Old Baldy's" shop, my article would have had a very interesting ending, but as it was nothing happened—he got away with it. So the reader will have to imagine, if he can, what "Old Baldy" would have done to him.

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

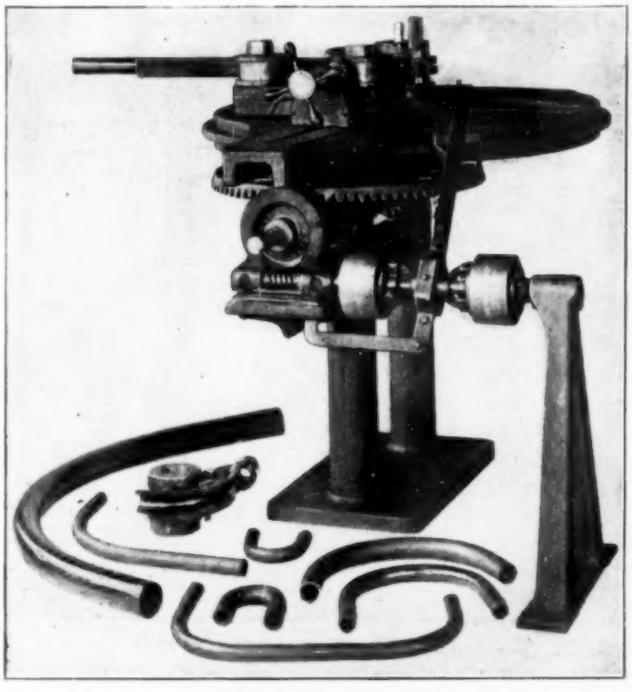
SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Wallace 5-A Bending Machine

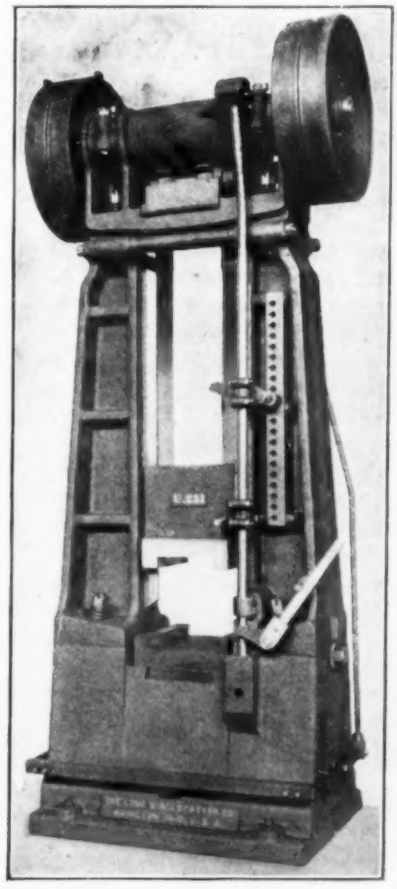
The machine shown is designed to bend cold bars of any shape as well as various sizes of pipe and is manufactured by the Wallace Supplies Manufacturing Co., 412-20 Orleans St., Chicago, Ill. The machine is controlled by a lever that engages friction-clutch pulleys for forward and reverse and is provided with adjustable stops to suit any degree of bend required. The stops are arranged to slide around the edge of the table and a table projection acts as an ultimate limit stop when a revolution is nearly completed. To bend angles, channels and similar material, it is first necessary to make a form and follower bar of correct shape. The material to be bent is clamped to the form, the follower bar operating between the material and the roller. When the bend is complete the machine stops automatically. The roller bracket for the follower bar is adjustable to and from the center, providing a range of circular bends as large as 25 in. radius. Machines with greater adjustment can be furnished when required. Distortion of the material being formed is prevented by a U-shaped clamping plate that holds the work close to the follower. When arranged for bending pipe the machine equipment includes four standard forming heads suitable for pipe ranging in size from 1 to 2 in. These heads will form bends of 90 deg., the radius ranging from 6 to 14 in., according to the pipe size. Bends can be made cold with the above equipment without the use of an inside follower or floating mandrel, and, it is claimed, without flattening the pipe. Special forms with inside follower bars or floating mandrels can be furnished to order for bending light gage tubing. The machine weighs approximately 1,200 lb.



WALLACE 5-A BENDING MACHINE

"American" Drop Hammer

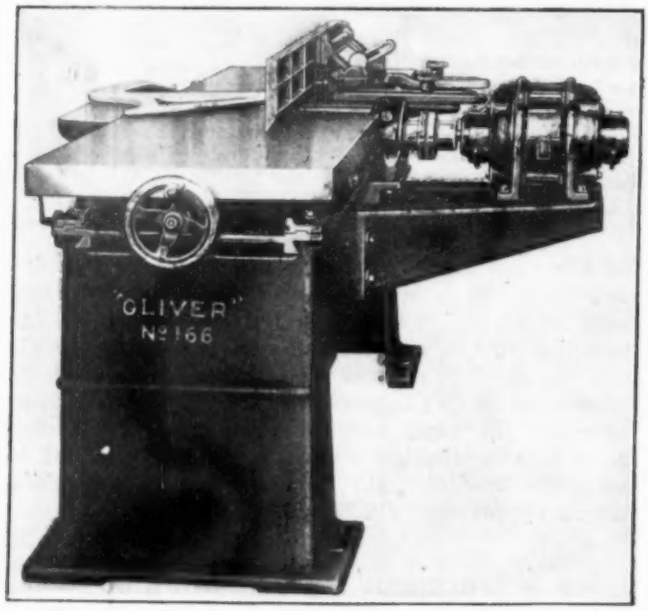
Board drop-hammers of the type shown are a late development of the Long & Allstatter Co., Hamilton, Ohio. Superfluous parts have been eliminated and the increased distance between the V-guides permits the use of extra wide dies, such as are used in the manufacture of agricultural machinery. The frame adjustment for aligning the upper and lower dies is designed for a movement of 0.004 in. and is prevented from loosening by a positive automatic arrangement. The weight of the anvil in proportion to that of the falling ram is approximately fifteen to one and means are provided for recording the various heights at which the ram should be released for each set of dies, thus assuring duplicate work at different periods. The hammer is made in eight sizes, with falling weights ranging in sizes from 100 to 1,200 pounds.



"AMERICAN" DROP HAMMER

Oliver Hand Planer and Jointer

The machine shown herewith, known as No. 166, is made by the Oliver Machinery Co., Grand Rapids, Mich., and is arranged so that a d.-c. motor or an a.-c. motor



OLIVER HAND PLANER AND JOINTER

for one, two or three phase in various voltages can be furnished. In other respects the machine is the same as described in the *American Machinist*, July 17, 1919.

Westinghouse "HK" Motor

For severe intermittent varying speed service where heavy starting torque is required, such as for cranes and hoists, the Westinghouse Electric and Manufacturing Co. has recently brought out the type "HK" direct-current, series-wound motor, especially designed for use where the load consists of a series of starts, stops and reversals.

WESTINGHOUSE "HK" MOTOR

The motor is of inclosed construction with small openings in the lower part for ventilation. Covered openings in the top half of the frame give access to the brushes and the commutator. A prominent feature is its compact construction, giving small overall dimensions, light weight and great mechanical strength.

The motor has a forged open-hearth steel frame and solid forged-steel feet, and when above 3 hp. rating is equipped with commutating poles so that high momentary loads can be carried without series sparking.

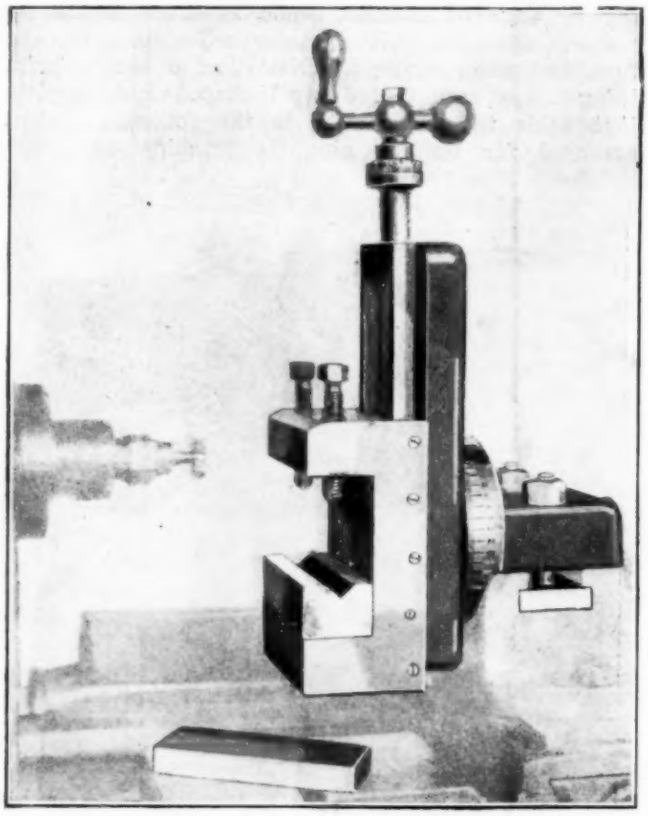
The armature coils are form-wound and thoroughly insulated and impregnated before being placed in the slots. A blower is placed in the rotor which effectively ventilates both armature and field windings. This allows a smaller diameter armature to be used, resulting in low flywheel effect, consequently, little energy is required to start and stop the motor.

Electrically operated, shoe-type brakes are supplied when ordered. They are bolted to the machined lugs on the motor bracket, making a compact unit of motor and brake. The brake is simple and rugged and provision is made for adjusting for wear of parts.

In order to utilize to advantage the ventilated feature the "HK" line of motors has been rated on the one-quarter hour basis.

Davis Milling Attachment for Lathes

The illustration shows the Davis milling attachment built by the Hinckley Machine Works, Hinckley, Ill. This attachment is held on the tool carriage of a



DAVIS MILLING ATTACHMENT

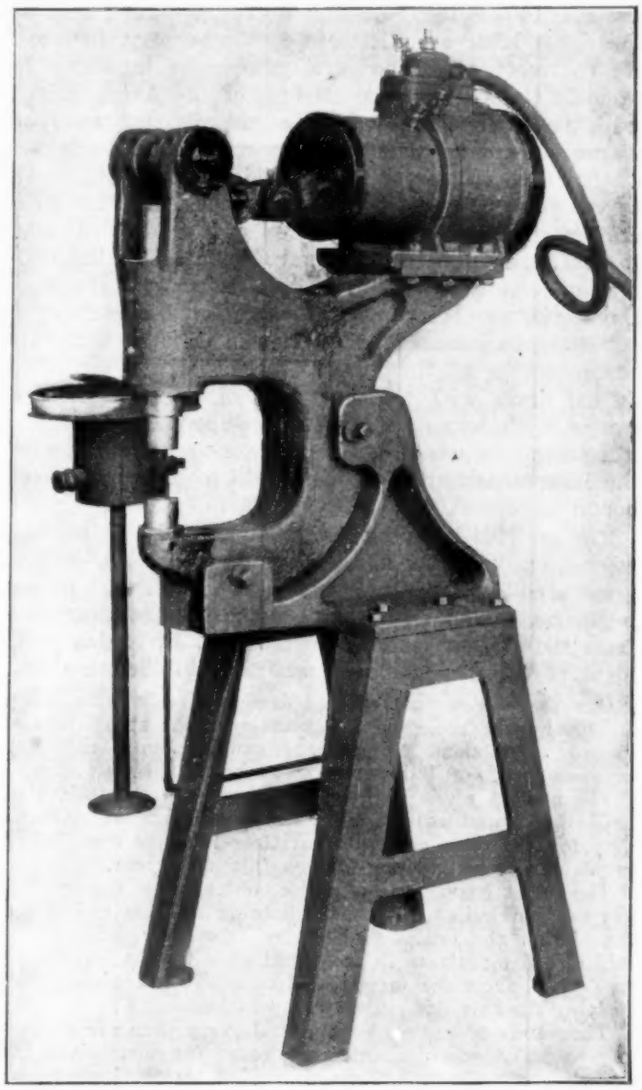
Specifications: Vertical hand feed, 7 in., graduated to 0.001 in. Will swivel in vertical plane to 180 deg. Vise jaws, 1¾ in. deep; 5/8 in. wide; maximum opening, 4 in. Weight, net, 50 lb.; boxed for shipment, 65 lb.

lathe and serves as a handy device for doing a great variety of milling such as keyseating, squaring ends of shafts, sawing, splitting bushings, drilling and boring.

The illustration shows the attachment in one position on the compound rest of a lathe. By swinging the compound rest it can be brought to any desired angle.

Baird Type Riveter with Stationary Mounting

The illustration shows a pneumatic riveter made by the Baird Pneumatic Tool Co., Kansas City, Mo., and supported on a stand instead of being suspended by a bail. The arrangement of the riveter and stand is intended for use in riveting traction plates on the rims of



BAIRD TYPE RIVETER WITH STATIONARY MOUNTING

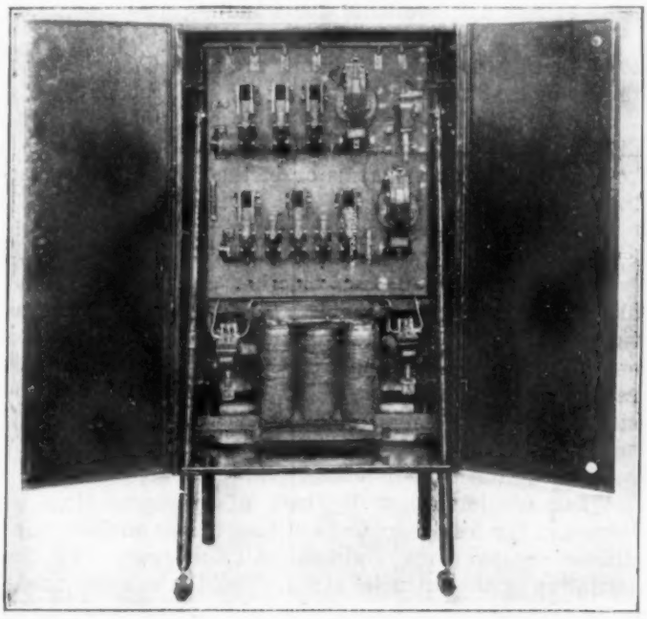
pneumatic tires. The riveter has a 10-in. reach, a 9-in. gap and will deliver a maximum squeeze of 70 tons with 100 lb. air pressure.

General Electric Automatic Starter for Induction Motors

The General Electric Co., Schenectady, N. Y., has developed the automatic starter, shown in the accompanying illustration, for use with squirrel-cage induction motors driving line shafts, pumps, compressors and similar devices. This starter is designed to start by push button, or by the operation of a float switch, pressure governor or some similar automatic accessory.

The starter consists of one 5-pole contactor for starting, one 3-pole contactor for running, a current-limit relay for controlling the contactors, two inverse-time-element overload relays and a set of compensator coils. All this apparatus is mounted on a panel and inclosed in a case which can be locked shut when desired.

The acceleration of the motor is accomplished independently of the operator's judgment. This is accomplished through accelerating relays or current-limit relays, which operate the contactors so as to disconnect the auto-transformer, and to connect the motor on the line



GENERAL ELECTRIC AUTOMATIC STARTER NO. CR-7052 FOR INDUCTION MOTORS

when it is properly accelerated. In starting, the operation is as follows: When the master switch is closed, the 5-pole starting contactor is closed, which connects the compensator coil to the line and to the motor primary leads, thus reducing the starting voltage on the motor. The accelerating relay is also connected to the line circuit, and it operates at a pre-determined current value, opening the circuit to the starting-contactor coil and closing the circuit of the 3-pole running-contactor coil. This circuit is held closed by means of a small shunt coil.

The starting contactor is provided with an interlock, normally open, which makes it unnecessary to hold in the start button or other device during the starting period.

The contactors have solid copper contact tips that are easily renewable, and they are provided with magnetic blow-outs and moisture-proof coils. The compensator winding has two coils for 2-phase motors and three for 3-phase, so as to give balanced starting currents and maximum starting torque. Overload protection is furnished by the two inverse-time-element relays, which are operative during both starting and running. After an overload they may be reset without removing the cover of the inclosing case, by means of handles which project through on the back of the panel.

What Other Editors Think

We Must Save the Railroads

From *Manufacturers' Record*

A MILLION tons of steel and iron are reported as on the cars in the Pittsburgh district, which cannot be moved because of freight congestion.

Much of last year's grain is piled on the ground in Kansas and Texas and elsewhere because cars and locomotives are not available for handling it.

Manufacturers have in some cases sold their product for a year ahead, but their plants are almost idle because they cannot ship the stuff.

Merchandise, manufactured and farm products, running in value to billions of dollars, are held in warehouses, or in cars, on farms or in the factories, because the stuff cannot be moved.

The railroad system of the country, partly through lack of management and partly through unwise Governmental regulation and inaction, is being strained almost to the breaking point. The lack of transportation has already cost the country in the last ten years an amount probably equal to the total invested in all railroads. Our development has been halted, the expansion of trade at home and abroad has been throttled, and the wealth which might have been created has not been brought into existence.

What we have lost by lack of transportation is, however, far less than we will lose unless present conditions are promptly righted. All the energy, all the initiative of the financial strength of the country needs to be thrown into the expansion of transportation facilities ere it be too late to save business from a collapse.

The folly of those who years ago made investments in railroads practically impossible by insisting that railroad builders and investors should have not more than a nominal rate of income, and their action in keeping capital out of railroads by unwise legislation and demagogic appeals to the mob spirit, has cost the country so many billions of dollars that it is difficult to measure the evil influence of the blind leaders of the blind in the fight against a full measure of profit on railroad investments commensurate with the profit in industrial and banking and mercantile properties. We are paying the penalty, and paying it by the billions.

A solution of this great problem is essential to the salvation of our business interests from a breakdown.

Putting aside all of the prejudices of the past, all of the hostility to the railroads engendered by unwise railroad managers, the nation must recognize that it is the people who are suffering more than the railroads.

Unless our railroads are saved and expanded the aggregate loss to the people will be far greater than the total loss to stockholders would be if every dollar of investment in railroad property was wiped out.

With these facts driven home to every farmer and merchant and manufacturer, every professional man and every day laborer and mechanic, there should come a new spirit of appreciation of railroads before there can be a rebirth of railroad expansion in keeping with the country's needs.

An Honorable Labor Union

From *Iron Age*

WHEN the steel strike of last fall was declared, and for some time afterward, the radical leaders, of whom the most prominent was the syndicalist, William Z. Foster, were unable, by pursuasion, intimidation, or any other means, to force the Amalgamated Association of Iron, Steel and Tin Workers, one of the oldest labor organizations in the country, to break its contracts with the steel companies in order to promote the strike. The attitude of the Amalgamated made it so unpopular with the radicals that an open disruption was imminent. The soreness which was felt at that time was never healed, and has just culminated at the recent Montreal meeting of the American Federation of Labor in the decision of the Amalgamated to withdraw from the National Committee of the Federation. At the meeting of the Federation, David J. Davis, vice president of the Amalgamated, said:

"The Amalgamated Association is through with this committee for all time, unless its officials get out. We do not agree with their methods of organization and cannot with honor continue to co-operate with them. The committee would have us violate our contracts with the independent steel concerns, which we are in honor bound to respect."

The position taken by the Amalgamated in Montreal, as well as its action at the time of the strike, reflects great credit upon it. We distinctly recall that at the beginning of the Foster steel strike the one clear note from the side of labor came from M. F. Tighe, president of the Amalgamated, who said to the members:

Our association has entered into contracts with many employers who recognize and treat with the association in its many functions. These contracts are bonds of honor between men, and it becomes us to honor them as such.

The pledges given by the officials and representatives of both the manufacturers and our association at Atlantic City to hold these contracts inviolate must be ever in the minds of our membership during this scale year.

The strict observance of these contracts on the part of our membership at this time will bring to them and to the association the credit that comes from fair dealing. It will also demonstrate to the world at large the benefits to be derived from the principle of collective bargaining, embodying the spirit of mutual co-operation.

Thousands of our members at this very time are preparing to make every sacrifice to secure for themselves the principle of collective bargaining. Let those of our membership who have that prize show by their fealty to that principle the benefits derived by strict adherence to every feature of it.

It is worth while at this time to recall the above words and realize that there are still some labor leaders who adhere to the old-fashioned notion that a contract is a contract, which even the labor union has no right to violate. It is not surprising that the Amalgamated is breaking away from the Federation, whose president failed to take any stand against the syndicalist, Foster, when the evidence of the vicious teaching of that radical was presented to him.

Business Conditions In England

FROM OUR LONDON CORRESPONDENT

SOMEWHAT sensational reports from New York regarding falls in retail prices were taken up by the press here; let us hope with the view that few things are more effective than example. But when thoughtful articles on the American position reached Great Britain, such as that on the subject contributed by Alexander D. Noyes to your *Evening Post*, it was concluded that general conditions on the two sides were not so very different. We saw the storekeepers in New York advertising in your papers: "The message is sweeping the country. Less 20 per cent.—one-fifth off;" and after a lengthy interval they are being imitated by somewhat similar storekeepers in London, but the reduction offered is considerably lower.

This notwithstanding, the cost of living still tends to rise and is at somewhere about two and one-half times the figure of the immediate pre-war period. Such declines as are noticed are mainly of seasonal good, and even here prices were lower a year ago when under government control. Others relate to articles of food (canned) which the average British person would be more or less content to go without.

Settlement of the cost of living problem has been of real importance to the whole future of the country, because most claims for wage increases have been based on such figures. But for some time a departure has shown itself. The rise in status, as measured by wages, of a body of workers is being boldly urged, one trade or industry being pitted against another by the respective trade union leaders. Once again the women are said to be the tempters. Mrs. Railway worker finds herself a much less considerable purchasing, and therefore social, power than her neighbor Mrs. Docklaborer.

The demands of the railway men have already increased the wages paid yearly on the railways by something like £100,000,000; that is, as compared with pre-war period. Now further moves have been made. The effect will be seen in the estimate that, if the new claims are substantiated, a fare which up to three or so years ago was 20s. will necessarily be increased to 42s. Fares have already been raised by 50 per cent and the new demands imply a further increase by 40 per cent on present fares.

Certain retail businesses have for some few months been showing declines and prophets of bad times ahead have grown rather more numerous.

Real depreciation in the values, to use the commercial phrase, of non-ferrous metals is shown by a comparison of figures for the earlier months of this year. Copper has steadily declined; tin has shown an even greater fall; spelter (zinc) has gone down, and also has lead. In fact, a director of the British Metal Corporation thought fit to issue a circular ascribing the fall to excessive speculation for a rise, alarm at the possibility of a levy on increase in wealth, and withdrawal of credits by the banks. The price of Egyptian cotton, too, has shown marked declines and, because of shortage of orders, during the recent holiday period some Lancashire mills were closed down for a longer period than usual. No real alarm has however been manifested.

METALS AND MACHINERY NOT IN GREAT DEMAND

For various reasons, but mainly high prices, inquiries from the continent for most metal goods have fallen away markedly. But home orders in hand are numerous and no sharp decline need be anticipated. All the same, dates for delivery of engineering finished products certainly get shorter, particularly as applied to machine tools, and of usual sizes the smaller the tool the greater the likelihood (in fact, one might almost say certainty) of getting from stock.

A glance through recently issued lists suggests that British turret and capstan lathes can be obtained from stock up to about three months delivery, or five months for larger sizes. Ordinary center lathes are from stock in the smaller sizes up to three months, and vertical milling machines are entered at from stock up to three months. Small slotting machines can be obtained from stock and hobbing machines in from six to eight months. In short, the supply of machine tools from stock is now much more probable than it was at the beginning of the year.

Great Britain seems to have a plethora of automatics. Many are on the market in second-hand condition, this being a result of the sale of special munition plants, and the demand is by no means equal to the supply. The writer knows of a case in which a well-known American machine, delivered soon after the signing of the Armistice and not unpacked, was bought back by a representative of the firm concerned and sold recently at half the recognized price. Doubtless in this instance special causes could be found. The auction sales of government stocks removed from munition and similar factories continue, and no difficulty is experienced when the tools are of a form that is suitable for peace production purposes. On the other hand, special shell boring and turning machinery is frankly being advertised and offered for sale by weight.

An insight perhaps into the heavier side of the machine-tool market can be gained by comparing two quotations for lathes of practically the same size and type and both from the same manufacturing center. In one instance the machine was 36 in. in height of centers, admitting 16 ft. 6 in. long and weighed 33½ tons. The price, which was firm, was about £5,000, or say £170 to the ton, and delivery was promised for seven months. In the other case was a lathe admitting the same length between centers but 38 in. in height of centers, its weight being 45 tons net. Here the price was subject to the usual conditions and was just about £10,000, or more than £210 a ton, and delivery was in ten to twelve months.

THE OLYMPIA EXPOSITION

Incidentally, it may be suggested that the general commercial and industrial conditions will necessarily have their effect on the machine-tool exhibition which will be held at Olympia, London, W., from Sept. 4 to 25. The exhibition is of course organized directly by the Machine Tool Trades Association, the immediate successor of the Machine Tool and Engineering Association, which was formed at first as a protest against exploitation by private exhibition promoters.

Some few years ago a general engineering exhibition was held at Olylmpia, W., and the floor space of the hall was not more than half covered. The exhibits were mainly machine tools and there was no doubt that everyone showing was perfectly satisfied when, finally, expenses were compared with orders directly received. Consequently, when for the corresponding period of the following year a similar exhibition was projected the scheme was taken up much more thoroughly and the show was more nearly representative. But in the interval trade had slumped. The promoter made quite a considerable sum by way of stand rents, etc., but exhibitors were, owing to the fault of nobody, left in the cold. An exhibition may certainly give a fillip to trade, but will not readily contend against general declining conditions. This was seen at the Frankfurt Fair, held at the beginning of May; here, owing to what has been described as business stagnation, most of the exhibitors were disappointed.

Whether German advertisements shall be accepted by the British technical press has in the past few years been largely decided, it would seem, by various trade organizations that have sprung up or were in existance before the war. The Machine Tool Association, for example, caused its members to insert a clause in their contracts reserving the right to cancel if advertisements of German manufactured goods were also taken. The Federation of British Industries has now, it seems, been approached for a state-

ment of views, but declined to express any definite opinion, leaving the matter for the decision of the individual trader.

By the way, a new business district is being developed between Victoria Station and Hyde Park, a district which will be known to Americans in London having occasion to pay visits to their own government official headquarters. The Associated British Machine Tool Makers, Ltd., now of course have their center in Grosvenor Gardens, having moved from Victoria St. some time ago; near by, they have as neighbors the Cambridge & Paul Instrument Co., Ltd. The would-be tenant in this district however has to go warily, for sub-leases are as numerous as in the case of a successful London theater, and every agent and intermediate lessee has to be indemnified.

The Gas Supply

Through the president of the Board of Trade the government has introduced a bill for fixing the price and quality of gas supplied by municipal corporation and public companies. Instead of the illuminating value, the thermal value of the gas is to be the basis of charges. That is, gas will be sold at so much per 100,000 British thermal units, and the official name for this unit is the therm. The standard price is to correspond, as well as is possible, with the ordinary price per 1,000 cu.ft., allowing for increases in costs and charges since the opening of the late war. It is also proposed that the dividend payable shall depend on the price of gas supply. This has applied to many cases in the past, dividend and price per 1,000 cu.yd. varying inversely, the lower the price the higher the dividend permitted by law to be declared, provided of course it is earned. As is usual, before alterations can be made in declared thermal value the company or corporation supplying the gas must, at their own expense, effect the necessary alterations or replacements in the burners for the consumers. Other provisions relate to the appointment of gas examiners, etc. The minimum pressure in any main or service pipe of 2-in. diameter or upward is to be 2 in. of water, "except as may be otherwise provided." To administer the act a gas fund is to be formed, to be raised from the various undertakings by a levy not exceeding £15 per 100,000,000 cu.ft. of gas made. Undertakings making less than 100,000,000 cu.ft. of gas in the year, these totalling about 10 per cent of the gas made, are exempt, as not justifying cost of collection. It is expected that more than £30,000 will be thus levied per annum.

The Austin Motor Co., the finance of which has been receiving some measure of public criticism, is, it is claimed, now in full producing condition as regards chassis and tractors; that is, for the capital at present issued. Apparently about 2,000 of the new Austin motor cars and 600 agricultural tractors have been delivered, foreign markets being particularly considered in the distribution. In fact, according to the directors' report, the company pursues a definite policy in this respect. It is admitted that the issue at the beginning of the year of £1,500,000 of 10 per cent preferred ordinary shares did not meet with a very ready response from the public, though it was fully underwritten.

In view of failures that have been recorded in these columns (some are being redeemed, though) it may be well to state that the new appeals to the investing world in connection with housing loans promoted by the counties round London have been a considerable success. On the other hand, the new treasury bonds, intended to deal with a floating debt of £1,000,000,000 or more, cannot be so described. The latest figures that have come to the notice of the writer indicate a subscription of about one and one-third million pounds a week. It is recognized that the floating debt must be reduced rapidly, but the terms of the new bonds, with their rate of interest that varies according to circumstances, seem to be rather too complicated for the average investor.

Whatever may have been anticipated of the effect of budget proposals on company promotion, the fact is that registration of new companies has been proceeding at the rate of thirty and more companies a day, the cinema business being responsible for more than a fair proportion. The average capital suggested is perhaps lower than had been expected, the higher duty imposed by the budget having its effect.

Industrial Reviews

Halifax.

The further advances in the prices of all classes of iron and steel goods, necessitated by the increased cost of fuel, have brought a temporary pause in business. Quotations for high-speed steels have advanced between 20 and 30 per cent, the trade having derived substantial benefit from the United States market.

In some quarters there is an impression that the top of the boom has been reached. Crucible-steel makers are not as busy as was anticipated, but, judging by the orders being placed for electric steel melting furnaces, there are evidently those who have faith in the future. We understand that the rolling mills and steel foundries are congested with work. At the moment there is a very heavy call for marine castings from the shipbuilding centers in the north and to a lesser extent on export account. Makers of mild steel continue to handle a big weight of orders. Makers of mining plant have a good number of orders in hand for South Africa and Australia. Belgium and Japan are also good customers just now. There is an excellent demand for automobile steel, especially case-hardening material.

Evidence of easier conditions in the heavy engineering trades has become increasingly apparent during the past week or two. Apart from the holidays, the chief cause appears to be the marked falling off in the demand from continental markets. Substantial contracts placed by firms in France and Italy have been modified and others definitely cancelled.

The high costs of production continue to be a serious menace. Again, the Halifax Corporation has increased its rates 6s. 11d., now making the total rates 19s. 9d. in the £. In addition, the assessment of business premises, offices, etc., has been put up 25 per cent.

A few calls among Leeds engineering works show most branches visited to be in a very healthy condition, though shortage of plates still hampers the locomotive builders and the difficulty of obtaining adequate supplies of castings has a restricting influence on output. Electrical engineers, locomotive builders and hydraulic engineers all seem to have as much work as they can conveniently handle. Rice & Co., Ltd., have a wide range of hydraulic machine tools in progress; these include portable hydraulic riveters and presses of fairly large dimensions.

Crosthwaite Engineering and Furnace Co., Ltd. (formerly Scriven's), report a good demand for shipyard and constructional engineering plant. We may specially mention a 5-in. bar shearing machine and a four-spindle horizontal machine designed for drilling the holes in rails for the fish bolts. The drills operate in pairs from both sides of the rail. The spindles are 3 in. in diameter and the weight of the machine is 4½ tons. In this firm's plate-edge planing machine plates up to 35 ft. in length can be dealt with. The driving screw has a double thrust bearing, while the toolholder is arranged to turn over by hand for double cutting.

Fairbairns have recently completed the first of a batch of vertical drill machines. These tools are driven by fast and loose pulleys through a nine-speed gear box, the diameter of the spindle is 2½ in. and the distance from the center of spindle to column is 18 in. The machine is capable of drilling 2½-in. holes in steel and the approximate weight is 3½ tons. This firm is experiencing a good local demand as well as a good demand from abroad. They recently completed a 20-ton propeller turning lathe with 36-in. centers, and have improved their planing machines. New patterns are now available for planing from 2 ft. square to 16 ft. square up to any length.

The demand for locomotive shop tools is well maintained. This firm recently built a machine for cutting-off the rising heads of steel railway wheels. It weighs approximately 9½ tons without the motor, and the distance from the spindle to the bed is 3 ft. 6 in. The spindle has a 24 in. hole through and an outer stay supports the work. The drive is by a 30-hp. variable-speed motor, while the floor space occupied is 9 ft. 6 in. x 4 ft.

J. Buckton & Co., Ltd., Leeds, recently completed a batch of very powerful vertical-spindle boring mills, with electric motor drive. The diameter of the work table is 50 in. The spindle, 9 in. in diameter, runs in an adjustable bearing, with an improved footstep bearing, the weight of the table proper being taken on circular ways submerged in an oil bath. The boring bar is balanced by a counterweight and has 34-in. variable automatic feed through rack and pinion, worm and wormwheel, and positive gears with disengaging motion and quick hand adjustment. A horizontal hub facing slide similarly has self-acting or hand feed motion, automatic stops being fitted. The work table is driven by a direct-geared variable-speed 15-hp. motor, or by cone and belt drive; in either case a 3-speed change gear box is used, the final drive being by spiral pinion or multi-thread worm of hardened steel, meshing with a cut ring on the faceplate. A friction clutch is fitted for quick stopping and starting, and for safety. If required, the table can be fitted as a 5-jaw concentric chuck with the jaws also separately adjustable.

BIRMINGHAM.

While there is no such serious relapse as to affect current activity in the shops there is a pause in buying perceptible enough to cause questionings as to what it portends. For the time being there are orders on hand which assure employment for some little time to come. Makers of special tools have still considerable arrears to overtake. As regards the general run of common types and sizes, however, delivery can be obtained much more quickly than was the case at the beginning of the year, and buyers are increasingly disinclined to place orders far in advance.

The salient fact in the local situation is that the automobile industry is not opening out opportunities of new business on any great scale. An immense amount of plant has been installed since the armistice, and from one cause and another these installations are not giving results which are calculated to stimulate new enterprise. Output is still suffering from the after-effects of the strike in the foundries and makers of incidental parts and accessories are alleged to have let the motor engineers down by their failure to execute orders punctually and their unreadiness to accept risks with regard to firm contracts at practicable prices. The new taxation proposals have resulted in the cancellation of some orders for cars. This does not cause any immediate concern, as the demand is still much larger than the output and some of the big makers are glad to be able to give more attention to their heavy commitments abroad. The large importation of American cars is being jealously watched and endeavors are being made to speed up production of those classes of cars for which buyers are being forced to look abroad. The cycle trade is not doing much at present in the way of new equipment. Rolling stock yards have plants which suffice for their present needs; in fact the difficulty is to get enough suitable labor. Future developments in this industry hinge very much on reversion to more reasonable prices.

Grinding machines continue in strong demand. Comparatively few find their way into stock, and in those rare instances they are soon snapped up. Generally speaking delivery cannot be obtained under about six months. There is still a brisk demand for planers. There is not the pressure for milling machines that there was, but business still reaches a fair level. A fair number of inquiries are reported for shapers. So much attention has been paid in recent years to gear-cutting installations that something of a reaction has supervened. Drilling machines are in moderately good request. The call for lathes is much less insistent. Toolroom equipment has been elaborated to such an extent that demand seems largly satisfied, though makers of small lathes for miscellaneous purposes are still getting a fair number of orders.

A scheme has been prepared for extending the Birmingham Corporation's electricity works at Nechells at a cost of over 1¾ million pounds. At present the city is without any reserve plant. Consumers are warned that there will be a substantial rise in the present charges for current.

The City of Sheffield Development Committee is issuing the third impression of their pamphlet on Sheffield and the Manufacture of Steel. The list of steel manufacturers will be useful for reference purposes.

We learn that by order of the Secretary of War the use of the metric system is to be discontinued in the American War Department. Despite other statements, its use extended no further than the graduation of gun sights, speedometers, and other instruments to make them conform to French practice and co-ordinate with French maps; in short there was no general adoption of the system.

Alfred Herbert, Ltd., Coventry, is now issuing a pamphlet giving a list of surplus stocks of engineers' small tools. Generally speaking, it is on much the same lines as those of the well-known list of machines in stock, etc. Discounts are stated. Apparently the new list is to be issued periodically. It starts with twist drills and ends with the metallograph for marking small tools, and this will indicate the range.

Sure! Why Not?

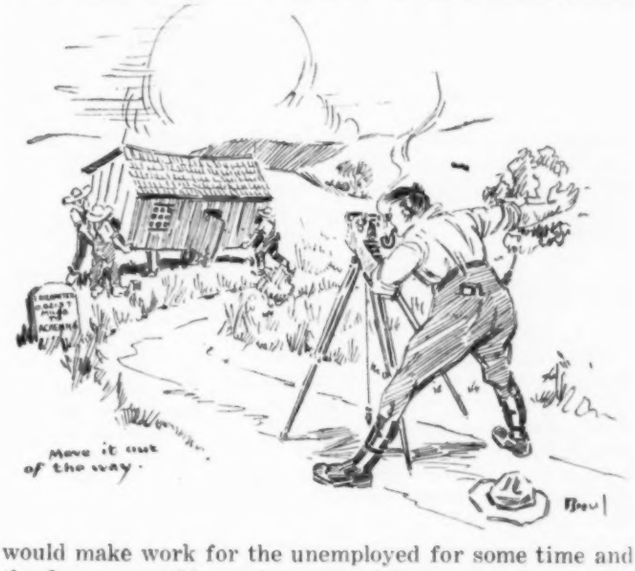
BY H. R. SMITH

Elstow, Sask.

Why all this fuss about the metric system? Why should machine tool manufacturers object to it? Machine tools and equipment need not be scrapped, but kept to make repair parts for machines in use until the latter are worn out. A lot of metric machine tools and equipment would be needed to make goods to the metric system and the purchaser of these, the maker of goods, could simply add the extra expense to the price of his goods and let his customer, the ultimate consumer pay it.

A repair man like me would keep all his present tools for repairing present machinery and get an outfit of metric tools for repairing metric machinery; adding cost of same to the bill of the ultimate consumer.

The country could be re-surveyed on the metric system, roads and fences shifted, and any building that would obstruct the new roads moved out of the way; this



would make work for the unemployed for some time and the farmers could pay for most of it (as they have most of the land) and charge it up to the ultimate consumer of their produce.

New railroad equipment of metric gage could be used with present equipment by adding an extra set of rails to the present track. It might take some work to arrange the switches but the section men could do that; they haven't much to do except in winter. The cost could be collected from the ultimate consumer, the passenger, on the ground of extra safety, for the extra rails would act as guards to prevent derailed cars running into the ditch.

P.S. Perhaps you had better not publish this, Mr. Editor. I happen to be an ultimate consumer of several things myself.

SPARKS FROM THE WOR

Valentine Francis

Whitman & Barnes To Manufacture Twist Drills and Reamers Exclusively

The Whitman & Barnes Manufacturing Co., Akron, Ohio, is now manufacturing twist drills and reamers exclusively. The merger of its two drop-forge and wrench factories at Chicago, Ill., and St. Catharines, Ontario, with J. H. Williams & Co., of Brooklyn, N. Y., was officially consummated on June 23.

A. D. Armitage, president of Whitman & Barnes, will be vice president of J. H. Williams & Co., and W. E. Rowell, Whitman & Barnes' secretary, Western manager of J. H. Williams & Co. at the Chicago factory.

The Whitman & Barnes Manufacturing Co. will remain in the twist drill and reamer business exclusively, retaining for this purpose its Akron, Ohio, factory where twist drills and reamers have been made in the past. A new and enlarged plant will be constructed, the plans for which are rapidly developing. When completed, the new factory will be the last word in equipment and facilities for producing twist drills and reamers and will rank among the largest in its class in the country. The present plant facilities are unable to supply the demand for its product and the company reports constantly increasing sales over production.

Coast-to-Coast Record Claimed by Packard

What is claimed as a record for a coast-to-coast truck run was established a few days ago when a Packard three-ton truck, equipped with Goodyear pneumatic tires, arrived in New York from Los Angeles, Cal., having made the entire distance of 3,451 miles in 13 days, 13 hours and 15 minutes.

This remarkable trip demonstrates the long distance hauling possibilities of motor trucks equipped with pneumatic tires. The previous record, made in 1918, for a coast-to-coast trip stood at 17 days and 3 hours. The entire trip was made on one set of pneumatic tires without change.

One of the most interesting things about the record is the fact that it was made by a truck which was not especially constructed for the test. This truck already had rolled up a mileage of over 120,000 miles.

The truck was driven by Howard Scholler and Herbert R. Temple, of Akron, Ohio. It was equipped with 44 x 10 pneumatic tires on the rear and 38 x 7 pneumatic tires in front.

Meeting of American Society for Testing Materials

The American Society for Testing Materials, Engineers' Club Building, Philadelpnia, Pa., held its twenty-third annual meeting at the New Monterey Hotel, Asbury Park, N. J., June 22 to 25.

The first session opened on Tuesday, June 22, and after the usual business was transacted, reports and papers were read on non-ferrous metals and metallography. In the afternoon session, Wrought and Malleable Iron and Corrosion were reported on by committees and papers. Of the latter, H. A. Schwartz spoke on the "Effect of Machining and of Cross-Section on the Tensile Properties of Malleable Cast Iron."

The third session was held on Tuesday evening and included the president's address and reports of administrative committees. This session was followed by an informal dance and smoker.

Steel was the topic chosen for the fourth session and in this connection papers by J. E. Howard and H. M. Howe and E. C. Groesbeck were of interest.

The former's paper was entitled "Shattered Zones in Certain Steel Rails, with Notes on the Interior Origin of Transverse Fissures." Howe and Groesbeck's paper was on "Stresses Caused by Cold Rolling."

The following session covered committee reports and papers on a variety of subjects not analagous to machinery.

While You Are in France

Every member of every commercial body in the United States will be heartily welcome at the offices of the American Chamber of Commerce in France, 32 rue Taitbout, Paris, during his sojourn in France. Fine library facilities—private rooms for conferences—full lists of commercial houses—information on all France.

Every facility offered to Americans in America by its commercial organizations is offered to Americans in France.

Correspondence in relation to French business matters will be thoroughly answered or referred in the proper direction for a full answer.

Federated American Engineering Societies Endorsed by American Engineering Council

The Engineering Council has, in numerous ways, expedited the creation of a comprehensive, representative body to perform for the engineers of America in a larger fashion, such functions as it has performed for the past three years. At its meeting in October, 1919, the council endorsed the general plan for a national engineering council, as outlined by the joint conference committee of the founder societies.

On Jan. 23, 1920, it assembled in joint meeting in the Engineering Societies Building, the governing bodies of all its member societies and United Engineering Society, at which meeting the plan was given strong impetus. Through its Washington office, and otherwise, the council aided the organizing conference of technical societies, held June 3 and 4, in Washington.

At its regular meeting on June 17, 1920, after hearing a report on the organizing conference, the engineering Council took the following actions:

"Voted: That Engineering Council heartily endorses the plan of organization of the Federated American Engineering Societies and the American Engineering Council, adopted by the organizing conference of technical societies in Washington on June 3 and 4, and authorizes its executive committee to proffer and perform on the part of the council such assistance as may be practicable in completing the work of the organizing conference and of the joint conference committee of the founder societies in establishing the American Engineering Council.

"Voted: That Engineering Council authorizes its executive committee to deal with any question of co-operation with the joint conference committee of the founder societies, relating to the permanent organization of the Federated American Engineering Societies, which may come up during the summer.

"Voted: That the secretary be instructed to invite to future meetings of Engineering Council delegates of the societies participating in the organizing conference in Washington, June 3 and 4, and editors of technical journals who may be interested."

ALFRED D. FLINN, Secretary.

The entertainment committee did its work well, every amusement from roller-chair riding to golf being arranged.

LD'S INDUSTRIAL FORGE
News Editor

Charles A. Schieren Co. Has Motion Picture on Leather Belting

One of the most impressing things brought out in the Chas. A. Schieren Co.'s four-reel motion picture on the manufacture of leather belting, is the thoroughness with which hides are tanned and prepared. The time consumed before a hide is ready for shipment to the belt factory is from six to eight months.

From the tanneries the picture shifts to the New York factories where each separate operation in converting a hide into finished belting is shown. A great many special machines shown are interesting, and, on the whole, a correct idea is easily obtained of the processes used in belt manufacturing.

The picture opened with the president of the firm in consultation with two other officers. They did their parts admirably and there is no doubt but that they could become regular "movie" actors with a little coaching. In fact, the personnel of the company was well directed, but few being caught looking into the camera.

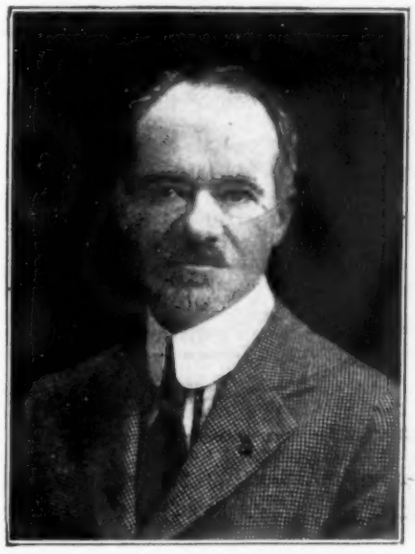
These reels were shown for the first time before a small audience invited by the Charles A. Schieren Co. at the Machinery Club, New York City, and were prepared at the company's tanneries, Bristol, Tenn., and at their factories and office, New York City. They are ready to be released in a series of educational industrial films. Any responsible organization can obtain a loan of the films or have them brought to their meeting and exhibited.

Henry McCoy Norris An Old Contributor to the A. M.

H. M. Norris has contributed to the *American Machinist* for over twenty-seven years. He was born at Trenton, N. J., on Jan. 21, 1868, and after concluding his studies at Lawrenceville, N. J., served an apprenticeship with Bement, Miles & Co., Philadelphia, Pa. Later he spent a year at drafting with the Phoenix Iron Co., Trenton, N. J., and then entered the engineering course at Cornell University. In 1892 and 1893, he was draftsman at the Ferracute Machine Co., Bridgeton, N. J.; the Brown & Sharpe Manufacturing Co., Providence, R. I., and the Pond Machine Tool Co., Plainfield, N. J. In 1894 and 1895 he was superintendent and engineer of the Appleton Manufacturing Co., and the Riehle Bros. Testing Machine Co., Philadelphia, Pa. In 1896, he was general manager of the Campbell & Zell Co., Baltimore, Md., and in 1898 became a stockholder and the superintendent, engineer and works manager of the Bickford Drill and Tool Co., Cincinnati, Ohio. His present position is that of secretary of the Cincinnati-Bickford Tool Co.

He early turned his attention to the design of radial drilling machines, and in 1901 published some of his ideas in "56 Points of Vantage." Another of his designs was the high-speed lathe described in our issue of Jan. 11, 1903, and he has been granted patents on many later inventions.

His first article appeared in these columns Feb. 2, 1893, since which time



HENRY McCOY NORRIS

he has contributed nearly sixty others under such titles as: "Systematic Machine Designing," "A Simple and Effective Method of Shop Costkeeping," "Depreciation of Plant and Its Relation to General Expense," "The Premium Plan of Labor Remuneration," "Power Absorbed in Drilling Various Metals at Various Speeds and Feeds," "An Efficient Routing and Follow-Up System," "The History of the Drilling Machine," etc.

Mr. Norris has been president of the Ohio Society, Sons of the Revolution, governor of the Ohio Society of Colonial Wars, president of the Cornell Association of Southern Ohio and chairman of the Cincinnati Section of the American Society of Mechanical Engineers. He was chairman of the entertainment committee at the joint meeting of the A. S. M. E. and N. M. T. B. A. held in Cincinnati in 1917. He was an officer in the American Protective League and served in the Council of National Defense.

New York City No Longer the Sport of Truckmen's Controversies

The freight which has been accumulating since last March on the piers of the coastwise steamship companies in New York has now been practically cleared away.

This operation sets a mark in the industrial history of New York City from which reckoning will be made in the future. It establishes a new principle—the principle that the business of the city cannot be made the sport of controversies between employers and employees and that the public will hereafter define and maintain its right to the uninterrupted transportation of its merchandise.

The strike and walkout of the coastwise longshoremen began March 13. Union truckmen supporting this strike refused to haul freight to or from the coastwise piers.

The merchants of the city, after trying in vain to bring about a settlement of the difficulty, announced that they proposed to organize their own trucking facilities, which should give impartial service regardless of strikes.

The first step was the formation of the Citizens' Transportation Committee, which includes representatives of the Chamber of Commerce, the Merchants' Association of New York, the Board of Trade and Transportation, the Chamber of Commerce of Brooklyn and the Chamber of Commerce of Queens.

The committee's problem was twofold: First, to create a fleet of rented trucks, since it was not proposed to purchase them, and, second, to provide money for their operation.

It was decided to create an underwriting fund which would be available not only for the trucking enterprise but for any other demand that may be made in the campaign to put an end to the interruption of the transportation of merchandise in and out of the city and in the city itself. The underwriting fund was first set at $1,000,000, then raised to $5,000,000, and now it is aimed to obtain subscriptions of $10,000,000. Its collection is being carried on chiefly through meetings of trade and commercial organizations which undertake to raise money among themselves.

The announcement in the newspapers of what the Citizens' Transportation Committee intended to do brought offers of trucks. These came chiefly from individuals who tendered from one to three trucks, mostly with chauffeurs. In this way a fleet of about 250 trucks was secured.

It was not known when the enterprise was launched what the result was to be and the organizers, therefore, had to prepare for nothing less than a strike. It was thought quite possible that the teamsters and chauffeurs might walk out and endeavor to paralyze trucking of all kinds throughout the city. The committee, therefore, deemed it wise to prepare for such an event so far as possible and to take over all the trucking which union men refused to handle.

The committee established a principle that no strikebreakers were to be used, that all men employed should be New York men, that no private guards were to be employed, and that no employee of the committee should carry weapons of any kind. The policy was established that the constituted authorities should be asked to afford protection and that complete reliance should be placed upon them.

Trucks were engaged upon short-term contracts of two weeks with a renewal privilege. They were all five-ton trucks. Pier superintendents, helpers, longshoremen, checkers, clerks, and all the various employees which the enterprise required were engaged. In supplying the personnel, it was made clear that no man desiring to work would be discriminated against because he was a union man.

It was decided to incorporate the trucking facilities under the name of the Citizens' Trucking Company, incorporated. This company is now a permanent concern, ready at all times to render impartial trucking service if existing trucking companies refuse to handle the business to the detriment of the city's commerce and trade.

This company obtained the names of the consignees of the freight held up at the coastwise steamship piers and canvassed them for authority to remove this freight. Consent was rapidly and in most cases enthusiastically given.

The unions at first were skeptical of the ability of the commercial organizations to establish their trucking machinery upon such short notice. They called the movement "a bluff" and declared that the enterprise which had been undertaken was "impossible of performance." They, therefore, remained quiescent for the first week of operations, but when they saw that goods were actually carried to and from the piers they began to show activity through their pickets and their delegates. However, no violence was shown.

The most important result of the trucking campaign was to bring independent truckmen upon the piers. It was, of course, impossible for the committee to create almost overnight a trucking concern of high efficiency, but when the small independent truckmen saw that freight was being moved from the piers without precipitating violence they began to take orders and they have actually moved more than twice as much freight as the Citizens' Transportation Committee's organization has moved. This participation was welcomed by the committee as the fulfillment of its chief object which is to insure the uninterrupted movement of merchandise.

The Citizens Trucking Co. is about to be placed upon a self-sustaining basis and the volunteer emergency force will retire from its operation until called upon to meet some new emergency.

Being Faithful

By Lucille Crites

Every feller can't be wealthy;
Lots of folks must still be poor,
Just one President is needed
At a time, you may be sure.
All the folks can't boss the railroads,
Or be in a Senate fight;
But each man can still be faithful
To his job—and do it right.

—From *Floating Power Plant News.*

Midwest Engine Co. Being Reorganized

Plans for the complete reorganization of the Mid-west Engine Co., Indianapolis, Ind., and for increasing its output to more than double its present capacity, were announced recently by Stoughton A. Fletcher, principal shareholder of the company.

According to Mr. Fletcher, articles of incorporation of the new company, which is to be known as the Midwest Engine Co., will be filed with the State of Delaware.

The company has completed arrangement for issuing $8,000,000 of preferred stock.

Associated with Mr. Fletcher in the reorganized company are a number of the most successful manufacturers in the Central West, including Lucius M. Wainwright, president of the Diamond Chain and Manufacturing Co.; Walter C. Marmon, president of the Nordyke and Marmon Co.; J. J. Cole, president of the Cole Motor Car Co.; Carl G. Fisher, formerly president of the Prest-O-Lite Co.; Charles B. Sommers, president of the Gibson Co., and James A. Allison.

The Midwest Engine Co.'s main plant and general offices are situated in Indianapolis. The company owns a tract of sixty-five acres on which are buildings and shops having a total floor space of 208,000 sq.ft. The company also owns and operates a large plant at Anderson, Ind., devoted to the manufacture of pumps and small turbines. The company employs at present about 2,400 workmen, many of whom are skilled.

The Technical Institute of the Polish National Alliance of Cambridge Springs, Pa., has obtained from the Government $4,000 worth of machinery, at a cost of $600, in accordance with the provisions of the Caldwell bill, empowering the Secretary of War to sell equipment to technical and mechanical schools at 15 per cent of cost. During the war this institute executed many Government orders of machine tools for the manufacture of guns and bullets. In 1918, the Government sent 400 soldiers to the institute, where, under the guidance of Polish instructors, they became expert mechanics.

Obituary

Louis L. Brinsmade, formerly manager of the Westinghouse Machine Co., and previously for twenty-two years with the Western Electric Co., died on June 16 in New York at 235 West 103rd St., after a brief illness. At the time of his death he was at the head of his own machinery concern. He was born in this city in 1875, and belonged to the following clubs: Engineers, Lawyers, Crescent Athletic, Railroad and the Society of the Colonial Wars.

Personals

Stanley P. Rockwell has resigned his position as vice president of the Weekes-Hoffman Co., Syracuse, N. Y., to become metallurgist of the Whitney Manufacturing Co., Hartford, Conn.

Alfred Spangenberg has been appointed works manger of the Reading Valve and Fittings Co., Reading, Pa., having succeeded J. T. MacMurray, who has resigned.

Edward C. Bailey, formerly manager of the claims department at the plant of the Greenfield Tap and Die Corporation, Greenfield, Mass., is now office manager of the New York City store of the company. He has been succeeded in Greenfield by Harold Shumway who was formerly his assistant.

E. J. Boggan has recently resigned his position as factory manager of the U. S. Metal Goods Co., of Cleveland, to enter the executive organization of the Dittmer Gear and Manufacturing Corporation of Lockport in the capacity of sales engineer. He will devote his entire time to looking after sales matters including the supervision of sales representatives.

Alois Hauser has been appointed assistant to the works manager in charge of engineering, of the Timken Roller Bearing Co., Canton, Ohio. For the past several years Mr. Hauser has been efficiency engineer at the Saucon plant of the Bethlehem Steel Co.

H. L. Wheeler is now with the Carthage Machine Co., Carthage, N. Y., as assistant superintendent. The company manufactures pulp and paper mill machinery.

C. T. Stiles has joined the mechanical goods division of the United States Rubber Co., being located at its Philadelphia office. Mr. Stiles has followed the power transmission engineering

business for eighteen years and has been connected with some of the largest belt manufacturers in this country.

R. R. HOEFER, formerly in the New York territory for the Heald Machine Co., of Worcester, Mass., for several years, is now with the machinery department of the Cleveland Tool and Supply Co., of Cleveland, Ohio. Mr. Hoefer began his new duties on the 15th.

JOHN R. BENSLEY, vice president and general sales manager of the Mercury Manufacturing Co., tractor builders, has recently returned from a seven weeks' trip through the South and in the course of his itinerary he visited Memphis, New Orleans, Jacksonville, Charleston and Baltimore. Mr. Bensley reported great industrial activity throughout the South and looks forward to a good business from this region.

J. W. DE HAAS, director of the Dutch East Indian division of the American Steel Export Co., New York, has left on an extended trip to the Dutch East Indies, Straits Settlements, Federated Malay States, Siam, Indo-China and Burma, in the interest of his company and to develop the trade of these territories in American steel products. Mr. De Hass will be gone for about a year.

Business Items

The Safety Car Heating and Lighting Co., is preparing to move its factory from Jersey City, N. J., to New Haven, Conn., and will give up the Jersey plant entirely. The new factory was used by the Martin Rockwell Co., in the manufacture of munitions during the war.

The Anderson Brothers Manufacturing Co., Rockford, Ill., has moved to the new plant which it has recently built, located in the east end of town at Eighteenth Ave., and Kishwaukee St. This new plant gives the company considerably more floor space and it is planning to expand with increasing business.

The Kelley Foundry and Machine Co., Elkins, W. Va., general foundry and machine business, was organized recently with capital stock of $25,000; the incorporators are Samuel T. Spears, C. H. Hall, S. H. Watring, J. W. Watring, D. J. Blackwood, J. F. Kelley and J. P. Kelley, all of Elkins.

The plant of the Hawthorne Manufacturing Co., Bridgeport, Conn., including the buildings and land, was purchased at auction by Edgar W. Bassick, of the Bassick Co., of the same city, for $105,000. The equipment will be sold at auction later.

At a special meeting of the board of directors of SKF Industries, Inc., held May 13, 1920, the resignation of B. G. Prytz, as president, was accepted, Mr. Prytz having been elected managing director of the parent company, with headquarters at Gothenburg, Sweden. At the same meeting F. B. Kirkbride, vice president since the organization of the company, was elected president to succeed Mr. Prytz.

The Meigs-Powell Co., Montgomery Bldg., Milwaukee, manufacturer of calipers and other precision tools, has acquired a plant at 522 Sixteenth Ave., Milwaukee, which will give them 1,060 sq.ft. additional floor space.

The National Check Writer Co., of Webster City, Iowa, will move its manufacturing plant to Waterloo, Iowa. The company manufactures the National check writer, a machine used for protection in writing checks. The officers of the company are: H. J. Buell, president; W. J. Zitterell, vice president; W. B. Rooed, treasurer; J. A. Boeye, secretary; all of Webster City. The management of the factory will be in the hands of Waterloo men.

Aktiebolaget Galco, Ltd., Stockholm, Sweden, represented in the United States by American Galco Incorporated, Grand Central Palace, New York City, has discontinued its machine-tool business and will in the future devote its energies entirely to the export trade from Sweden. In this connection it has allied itself with Aktiebolaget Bofors, one of Sweden's largest manufacturers, owning extensive steel works, foundries, forge shops and machine shops and rolling mills in the town of Bofors, Sweden. The production in these plants will consist largely of bolt and nut forging and threading machinery, hardware specialties, axes and mining tools.

The Service Casting Co. has recently been organized at Blanchester, Ohio, and will specialize in making small gray-iron castings for the trade. The foundry has been in operation since Feb., 1920, doing contract work. The personnel consists of R. B. Huyett and Charles N. Secrist, both of whom have had wide experience in foundry and machine practice.

The Liberty Machine Tool Co., of Hamilton, Ohio, and the Rockford Lathe Co., of Rockford, Ill., are now represented in the New York district by the Henry & Wright Co., of 136 Cedar St.

The Bertschey Engineering Co., Cedar Rapids, Iowa, has taken over the interests of the Bertschey Manufacturing and Engineering Co., the Peerless V-Belting Co., and the Bermo Welding and Equipment Co. A. J. P. Bertschey is president and Glenn M. Averill, secretary.

The Bullard Machine Tool Co., Bridgeport, Conn., through its agent, Harry A. Burnes, Lovell Building, Stratford, Conn., will dispose of its plant on Broad, Allen and Lafayette Sts., and Railroad Ave., Bridgeport, Conn. The Bullard company has now moved to the new plant in the Black Rock section of Bridgeport. The old factories on Broad St. and Railroad Ave. comprise a floor space of 168,222 sq.ft. available for manufacturing purposes, complete with power, heating, lighting and sprinkler system. The new plant in Black Rock is the one constructed during the war to be used by the Bullard Engineering Works, in the manufacture of large guns, etc., and is a most modern and up-to-date plant in every respect.

The Gray Machine Tool Co., 2661 Main St., Buffalo, N. Y., held a stockholders' meeting and voted to change the name of the concern to the Gray Machine and Parts Corporation.

Chicopee Falls, Mass., is to have the headquarters of the automotive equipment department of the Westinghouse Electric and Manufacturing Co. G. B. Griffith is in charge of this branch of the company's business, but will make his headquarters in New York for the present.

The American Axle Co., Barton, Wis., is a new organization, being capitalized at $150,000. E. M. MacAvoy is president, Peter C. Wolf vice president and treasurer, and George H. Gabel secretary. The directors include W. C. Dayton, M. H. Grossman, Andrew Hauser, S. J. Driessel and H. W. Suckow.

It has been announced that the Silver Sheet Metal Works, of New York City, is now called the Eastern Sheet Metal Works, Inc.

New Publications

Automobile Starting, Lighting and Ignition Systems. By Victor W. Page, M. E., member S. A. E., author of "Automobile Repairing Made Easy," etc. 6th edition. 815 pp., 7 x 5 in., 492 illustrations. Published by the Norman W. Henley Publishing Co., New York. Price $3.

This book is the new 1920 revised edition. It is invaluable to motorists, students, mechanics and repairmen. The subjects are described in a simple, untechnical manner, being easily understood. All forms of automobile-engine electrical ignition systems are described; and included are authoritative series of instruction pertaining to starting and lighting systems and wiring diagrams. Storage-battery construction, charging and maintenance, magneto and ignition distributor timing, care of generators and motors, and systematic location of all electrical faults are also fully described. The book contains over 250 complete wiring diagrams and special instruction is given for using meters in testing. The book is claimed to be the most complete treatise of its kind, practically all 1920 electrical systems being described.

Electric Furnaces in the Iron and Steel Industry. By W. Rodenhauser, E. E., of Germany, J. Schoenawa, Metallurgist, of Austria, and C. H. Von Baur, E. E., formerly chief engineer of the American Electric Furnace Co. Translated from the original by the latter and completely rewritten for this revised third edition. 460 pp., 6 x 9. Illustrated by photographs, drawings and diagrams. Published by John Wiley & Sons, New York City. Price $4.50.

The opening chapters of this work are devoted to the history of the comparatively new art of making electric steel and to the principles underlying the electric furnaces employed. The various successful commercial furnaces are then taken up in detail. To avoid comparing one furnace directly with another the ingenious expedient of comparing each one with a theoretically ideal furnace has been resorted to. A general review chapter completes this section.

Part II deals with the practical features of the operation of electrical furnaces and with the electro-metallurgy of iron and

steel. The materials of construction are taken up in detail as well as the cost of operation of the various types.

We have taken occasion before to call attention to the involved or even incorrect English encountered in technical books and this one is no better than the average. In a case like this one, of a German work translated into English, there may be some small excuse for the Teutonic cast of an occasional sentence, but in books written by American engineers for American engineers to read, there is none whatever.

The reader's attention is called sharply to this defect by the preface to the third edition of this book. Not one sentence in it will stand analysis and the last one is practically meaningless.

Standard Educational Tests. Arranged and standardized by M. E. Haggerty, Professor of Educational Psychology, University of Minnesota. Published by the World Book Co., Yonkers-on-Hudson, N. Y. Price of a sample set of tests, 75 cents.

Two of the first tests in the series are intended for group intelligence testing, and another for testing both intelligence and achievement in reading at the same time in grades 1 to 3. For grades 3 to 9 two different tests are provided. The first test is an illustrated achievement examination in reading. The second is an intelligence test based upon the Army intelligence tests and adapted to both individual and group testing. The examiner needs scoring keys for each test and a manual of directions, the latter being a 64-page pamphlet with instructions for giving and scoring the tests. The examination booklets are sold in packages of 25.

The tests have several valuable features, as they are very easily given and scored and are suitable to pupils of different ages and conditions. The age, forms and grade standards given are based on the extensive use of the tests in both large cities, small towns and one-room rural schools.

Design and Construction of Heat Engines. By Wm. E. Ninde, M. E., Associate Professor of Mechanical Engineering, Syracuse University. First edition. 704 pp., 6 x 9. Illustrated by drawings and diagrams. Published by McGraw-Hill Book Co., Inc., 239 West 39th Street, New York. Price $6.

This treatise on heat engines is based on the author's twenty years of practical experience and his ten years as a teacher at Syracuse University. A good feature is the omission of the usual appendix tables which are found in all handbooks and which are generally superfluous in a book of this kind. The inclusion of the reciprocating steam engine, the steam turbine and the internal combustion engine in one volume has naturally resulted in some abridgement of the treatment of each one, but on the whole the information is sufficient for all ordinary requirements.

The book is somewhat marred by unedited "engineers'" English and the usual first edition proofreader's errors are present.

The following general headings are taken up: Part 1—The Heat Engine; Part 2—Thermodynamics; Part 3—Friction and Lubrication; Part 4—Power and Thrust; Part 5—Mechanics; Part 6—Machine Design.

Problems of Labor. By Daniel Bloomfield, Partner, Bloomfield and Bloomfield Boston. The Handbook Series, XXI and 436 pages, 5 x 7½ in., cloth board covers, $1.80. Published by the H. W. Wilson Co., New York City.

In this volume are assembled and reprinted some of the best things that have been recently published upon the following subjects related to labor: Causes of Friction and Unrest, Cost of Living, Methods of Compensation, Hours of Work, Tenure of Employment, Trade Unionism, Labor Disputes and Adjustment, Limitation of Output, Industrial Insurance, Methods of Promoting Industrial Peace, Occupational Hygiene, and Women in Industry. The articles are written by such experts as Louis F. Post, Frank W. Taussing, John A. Fitch, Lord Leverhulme, and Samuel Gompers, thus giving a wide range of view point. All phases of the labor problem are ably and concisely treated. The book is well indexed and a bibliography, classified according to the subjects covered by the reprinted articles, is provided.

The Engineering Index for 1919. Compiled and published by the American Society of Mechanical Engineers, 29 West 39th St., N. Y. 528 pages; 9¼ x 6¼ in.; cloth board covers.

The American Society of Mechanical Engineers acquired the Engineering Index at the close of 1918, and since that time has published it monthly in the Society's publication, *Mechanical Engineering*. The book under consideration is the first bound volume of the index brought out by the A. S. M. E., and it differs somewhat from the former editions. The arrangement of the topics is entirely alphabetical, there being no grouping of items under the different divisions of engineering, as was formerly done. Besides the information descriptive of each article indexed, such as the name, author, and the periodical in which it appeared, each item contains a brief note summarizing the article.

The Index contains over 12,000 items referring to articles in nearly 700 engineering and allied technical publications, and the staff of the Society has "endeavored to make it the most complete and comprehensive work of its kind ever published."

Catalogs Wanted

The United States High Speed Steel and Tool Corporation, Plant No. 2, Green Island, N. Y., would be pleased to receive catalogs from manufacturers of machinery in order to complete its files.

Trade Catalogs

Dyehouse and Bleachery Ventilation. Buffalo Forge Co., Buffalo, N. Y. Catalog No. 721, 8½ x 11 in. This company has studied and experimented carefully the problem of dyehouse and bleachery ventilation and is presenting to the public an illustrated catalog on this subject.

Insulating Materials and Supplies. Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. Catalog 5-A-1, pp. 24, 4 x 7 in. This catalog gives a complete list of all insulating materials and supplies manufactured by this company. Included in the list of products described are: mica micarta and bakelite plates and tubing, treated and untreated cloths and papers, insulating and soldering compounds, insulating oils and tapes.

Welding and Cutting Equipment. Davis-Bournonville Co., Jersey City, N. J. Catalog, pp. 15, 3¼ x 6½ in. This catalog describes briefly its oxy-acetylene and oxy-hydrogen equipment, portable outfits, acetylene, oxygen and hydrogen production, regulating and reducing valves, welding torches and tips, cutting torches and tips, welding and cutting machines, and oxygen and hydrogen plants.

How to Judge Engines. Witte Engine Works, Kansas City, Mo. Booklet, pp. 36, 10 x 12¾ in. This booklet has been written by Ed H. Witte, president of the Witte Engine Works, and gives a general description of engine construction and engine selling. The first few pages describe the Witte engine in the various sizes and styles, and the last half of the book covers in detail not only the construction of the Witte engine, but various other engines.

Measuring Machines. The Golden Co., manufacturers' representative, 405 Lexington Ave., New York. Catalog No. 234, 5½ x 8½ in. This catalog describes and illustrates the universal measuring machine which is used for the checking and control of standards and scales of every form. This machine is made by Société Genevoise d'Instrumens de Physique.

Sheffield and the Manufacture of Steel. City of Sheffield, England. This short pamphlet is designed to give information about Sheffield and its industries upon which its prosperity and facilities depend.

Hacksaws. L. S. Starrett Co. Athol, Mass. Booklet, pp. 63, 4½ x 7 in. This booklet is written for the large class of men to whom a hacksaw is merely a hacksaw; a tool whose proper use is not understood because they have not had the opportunity to learn, and this information is very valuable to machine-shop men. It covers experiences of all hacksaw manufacturers.

Tumbling Mills. Whiting Foundry Equipment Co., Harvey, Ill. Catalog No. 153, pp. 27, 6 x 9 in. The advantage of cleaning castings; description of operation on water cinder mills and the table of sizes is given in this catalog. Several different types of mills in some large machine shops are also shown. A copy of this catalog will be sent upon request.

Appliances for the Mechanical Transmission of Power. Fairbanks Co., New York City. Catalog No. 935, 7½ x 10½ in., 251 pages printed on excellent coated stock and clothboard covers, and replete with illustrations. This catalog supersedes all previous issues and covers completely the many lines handled by the Fairbanks Co.'s transmission. Tables and specifications have been worked out with care and precision to assist the purchaser to determine his transmission requirements. All in all, this catalog is one of the best that we have seen.

Oxy-Acetylene. Davis-Bournonville Co., Jersey City, N. J. Catalog, pp. 16, 6 x 9 in. This company has issued a temporary catalog of the Davis-Bournonville acetylene generators, welding and cutting torches, pressure regulators, portable outfits and supplies.

Bearing Alloy. The Ajax Metal Co., Philadelphia, Pa. Circular, 3½ x 6½ in. This circular gives several reasons why some industrial concerns have adopted Ajax ball-bearing alloy.

Gisholt Products. Gisholt Machine Co., Madison, Wis. Booklet, G. P. E., pp. 24, 5½ x 7½ in. This booklet illustrates only its various products such as turret lathes, vertical boring and turning mills, universal tool finders, drilling machines, toolpost holders, reamers, boring bars and chucks.

Automatic Chucking Machines, Automatic Screw Machines, Tractors, etc. The New Britain Machine Co., New Britain, Conn. Folder, 8½ x 11 in. This folder describes some of the automatic labor-saving machinery made by the New Britain Machine Co.

Sandblasts. Pangborn Corporation, Hagerstown, Md. Catalog, 4 x 9 in. This catalog is printed in Italian describing Pangborn sandblasts and allied equipment.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

An importing firm in Syria desires to be placed in touch with exporters of agricultural implements, trucks, machine tools, hand tools. No. 32,900.

A firm in Spain desires to purchase from manufacturers and export firms machine tools, lathes, etc. Quotations should be c.i.f. Bilboa. Correspondence should be in Spanish. References. No. 33,147.

A manufacturer in Belgium desires to secure an agency with stock of goods for the sale of machine tools, such as taps for gas and water, elevating apparatus, steel, files, bolts, screws, rivets, cotters, vise, anvils, ventilators and mortar engine. Correspondence and catalogs in French. No. 32,958.

A firm of engineers in Scotland desires to secure agencies for the sale of raw material such as pig iron, copper, zinc and tin; tools, lathes, drilling and milling machines. Quotations should be given c.i.f. Scottish port. Reference. No. 33,048.

Forthcoming Meetings

The International Railway Master Blacksmiths' Association will hold its next annual convention at Tutwiler Hotel, Birmingham, Ala., on Aug. 17, 18 and 19. The secretary of the association is A. L. Woodworth, Lima, Ohio.

The American Steel Treaters' Society and the Steel Treating Research Society will hold their second annual convention and exhibition at the Commercial Museum, Philadelphia, Pa., on Sept. 14 to 18, inclusive. J. A. Pollak, of the Pollak Steel Co., Cincinnati, Ohio, is secretary of the former society.

The American Foundrymen's Association will hold its annual convention and exhibit at Columbus, Ohio, on Oct. 4 to 9. C. E. Hoyt, 1401 Harris Trust Building, Chicago, Ill., is secretary.

An exposition of U. S. manufacturers at Buenos Aires, Argentine Republic, S. A., has been arranged for the month beginning Nov. 15. Information can be obtained from the American National Exhibition, Inc., Bush Terminal Sales Building, 132 West 42nd St., New York.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drilling Machine, Vertical, 20-In.

Holt Electric Co., 377 S. Pierce Street, Milwaukee, Wis.

"American Machinist," June 17, 1920

The machine has the standard form of column, with a 5½-in. diameter finished portion for the table arm. The rectangular base has T-slots, and the counterweight for the spindle is inside the column. The drive is through cone pulleys and belt, and a combined lever and worm feed is provided. Spindle: diameter, 1⅞ in.; vertical travel, 11⅛ in.; speeds, 4. Maximum distance: spindle to table, 25½ in.; spindle to base, 41⅞ in. Table diameter, 18 in. Countershaft speed, 350 r.p.m. Height, 73 in. Floor space, 41 x 16½ in. Weight, 750 lb.

Drilling Machine, Vertical, 16-In.

The Hoosier Drilling Machine Co., Goshen, Ind.

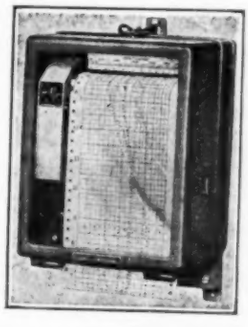
"American Machinist," June 17, 1920

This plain, belt-driven machine is designed for light and medium work. It is furnished with either a round table or with a square table having T-slots and an oil-retaining rim. Feed is by means of a hand lever. Column to center of spindle, 8 in. Maximum distance: spindle to table, 28¾ in.; travel of spindle, 8½ in. Travel of table, 19¾ in. Spindle speed, 46 to 971 r.p.m. Floor space, 19¾ x 26¼ in. Weight: net, 300 lb.; crated, 380 lb.; boxed for export, 500 lb. Export box, 15 cu.ft.

Recording Instrument, Pyrometer

Charles Engelhard, 30 Church St., New York

"American Machinist," June 17, 1920



The instrument has a continuous-roll chart, with a scale 5½ in. wide and calibrated in both temperatures and milli-volts, the time and temperature lines being at right angles to each other. There are two types of instrument, one for keeping a single record and one for keeping multiple records. The interior of the instrument is divided into two compartments, the moving system being enclosed alone so that it is protected from possible injury when the record charts are being removed or replaced. The clock mechanism and scale are mounted in the front compartment, which has a glass front. Size: height, 11 in.; width, 8½ in.; depth, 8½ in.

Guard, Safety, Power-Press

William A. Wiesman,
14 N. Canal St., Dayton, Ohio

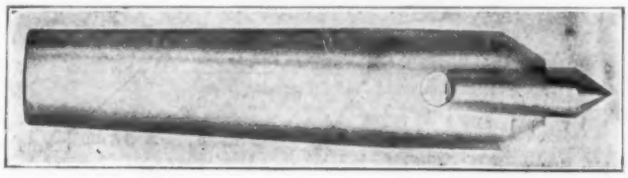
"American Machinist,"
June 17, 1920

The guard can be attached to the press without boring any holes, and it has only two moving parts. It does not touch the operator's hands unless they are on the die when the punch descends, in which case the guard brushes them aside.

Center Point, Inserted

The Federal Steel Co., Detroit, Mich.

"American Machinist," June 17, 1920

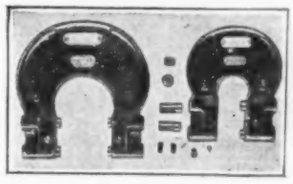


The inserted point of this machine center is made of high-speed steel, and both the point and the hole in which it fits are ground to Morse taper. The shank is made of carbon steel, hardened and ground, and is furnished in all standard sizes to fit Morse, Brown & Sharpe or Jarno taper holes.

Gage, Adjustable Limit

John M. Rogers Works, Inc., Gloucester City, N. J.

"American Machinist," June 17, 1920

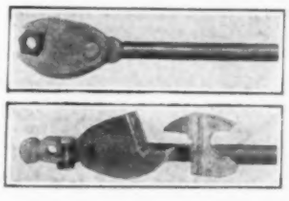


These gages are made in 22 sizes, the smallest having a range from 0 to ½ in. and the largest from 8 to 8½ in. The distance between the plugs may be set to any dimension within the range of the gage by inserting a standard measuring block between them, reference disks being supplied by the maker for setting the gages. The malleable iron frames are well seasoned and the holes for the plugs are line reamed. The anvils, or plugs, are of hardened steel, each plug being lapped on both the diameter and the gaging surface. Both anvils are locked by the same screw, which can be sealed, making the gage proof against tampering.

Wrench, Open-End, Ratchet

Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

"American Machinist," June 17, 1920

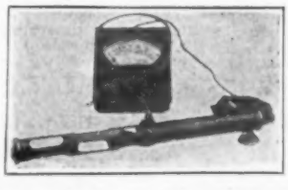


The wrench is adjustable to various sizes of nuts, and it automatically grips the nut when the handle is pulled, the grip increasing with the pull. The wrench may be used as a ratchet wrench, because the grip releases as soon as the pull is released. It is made in several sizes from drop-forged steel, the jaws being machined and hardened.

Pyrometer, Fixed—Focus

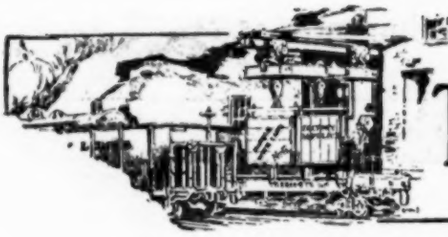
Foster Instrument Co., Letchworth, England

"American Machinist," English Edition, May 29, 1920



This pyrometer is made in three types, a portable set (illustrated), an inspector's outfit and a tripod set. The tube of the pyrometer is slotted to enable the escape of fumes that might get into it. There is a diaphragm at the front end through which the heat rays from the hot object enter and strike a focusing mirror at the center of the tube. The heat rays are reflected on to the junction of a thermo-couple contained in the back end of the tube and connected electrically to a moving-coil milli-voltmeter which serves as an indicator. A recording indicator operated by clock mechanism is also made. A sighting device is provided for pointing the tube at the work. The heat received by the thermo-couple is independent of the distance from the hot body to the instrument within certain limits.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	Current	One Year Ago
No. 2 Southern	$45.60	$29.80
Northern Basic	42.80	27.55
Southern Ohio No. 2	46.80	28.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	49.65	31.90
Southern No. 2 (Silicon 2.25 to 2.75)	49.70	33.95
BIRMINGHAM		
No. 2 Foundry	42.00@44.00	25.75
PHILADELPHIA		
Eastern Pa., No. 2x, 2.25-2.75 sil.	46@48.25*	30.65
Virginia No. 2	45.00*	30.85
Basic	44.50†	29.90
Grey Forge	43.50*	29.90
CHICAGO		
No. 2 Foundry local	44.25	27.25
No. 2 Foundry, Southern	47.00	31.75
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry	45.65	28.15
Basic	44.40	27.15
Bessemer	44.90	29.35
MONTREAL		
Silicon 2.25 to 2.75%	43.25	.....

* F.o.b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York Current	New York One Month Ago	New York One Year Ago	Cleveland Current	Cleveland One Year Ago	Chicago Current	Chicago One Year Ago
Structural shapes	$4.47	$3.97	$3.47	$5.50	$3.37	$3.97	$3.47
Soft steel bars	4.62	4.12	3.37	5.00	3.27	3.87	3.37
Soft steel bar shapes	4.62	4.12	3.37	.....	3.27	3.87	3.37
Soft steel bands	5.82	5.32	4.07	6.25	.....	.....	.....
Plates, ¼ to 1 in. thick	4.67	4.17	3.67	5.00	3.57	4.17	3.67

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, Pittsburgh	$4.25	$2.75
Warehouse, New York	4.57	3.37
Warehouse, Cleveland	3.52	3.22
Warehouse, Chicago	3.75	3.37

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Large Mill Lots Pittsburgh	New York Current	New York One Year Ago	Cleveland	Chicago
No. 10	3.55-6.00	7.12@8.00	4.57	7.55	7.02
No. 12	3.60-6.05	7.17@8.05	4.62	7.65	7.07
No. 14	3.65-6.10	7.22@8.10	4.67	7.70	7.12
No. 16	3.75-6.20	7.32@8.20	4.77	7.80	7.22
Black					
Nos. 18 and 20	4.15-6.30	8.50@9.50	5.17	8.20	7.80
Nos. 22 and 24	4.20-6.35	8.55@9.55	5.22	8.25	7.85
No. 26	4.25-6.40	8.60@9.60	5.27	8.30	7.90
No. 28	4.35-6.50	8.70@9.70	5.37	8.40	8.00
Galvanized					
No. 10	4.70 7.50	9.75@11.00	5.50	8.50	8.15
No. 12	4.80 7.60	9.85@11.00	5.55	8.60	3.20
No. 14	4.80-7.60	9.85@11.10	5.60	8.60	8.35
Nos. 18 and 20	5.10 7.90	10.10@11.40	5.90	8.90	8.65
Nos. 22 and 24	5.25-8.02	10.25@11.55	6.05	9.05	9.05
No. 26	5.40-8.20	10.40@11.70	6.20	9.20	9.20
No. 28	5.70-8.50	10.70@12.00	6.50	9.50	9.50

Acute scarcity in sheets, particularly black, galvanized and No. 16 blue enameled. **Automobile sheets are unavailable except in fugitive instances, when prices are 9.45c per lb. for No. 16; 9.50 for Nos. 18 and 20, and 9.55c for Nos. 22 and 24.**

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$6.25	$5.80	$6.00
Flats, square and hexagons, per 100 lb. base	6.75	6.30	6.50

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	50
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$20.00	$25.50-30.00
Cleveland	20.00	20.00
Chicago	21.00	16.50

In coils an advance of 50c. usually is charged
Domestic iron (Swedish analysis) is selling at 12c. per lb.

WELDING MATERIAL (SWEDISH)—These prices are the best we have been able to obtain for Swedish welding materials, of which it is reported that very little are on the market.

Welding Wire		Cast-Iron Welding Rods	
1/16, 3/32, 1/8, 5/32, 3/16, No. 8, 7/32 and No. 10, 1/4, No. 12, 9/32, No. 14 and 5/16, No. 18, No. 20	21.00 to 30.00	1/8 by 12 in. long	14.00
		5/32 by 19 in. long	12.00
		3/16 by 19 in. long	10.00
		1/4 by 21 in. long	10.60
		Special Welding Wire, Coated	
		1/4	33.00
		5/16	30.00

Domestic—Welding wire in 100-lb. lots sells as follows, f. o. b. New York: 5/16, 8½c. per lb.; 1/4, 8c.; 7/32 to 1/8, 7½c.

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	7.00	8.00	9.00
Spring steel (light)	10.00	11.00	12.25
Coppered bessemer rods	9.00	8.00	6.75
Hoop steel	6.07	6.50	5.32
Cold-rolled strip steel	12.50	8.25	10.75
Floor plates	6.80	6.00	6.77

PIPE—The following discounts are to jobbers for carload lots on the Pittsburgh basing card, discounts on steel pipe, applying as from January 14, 1920, and on iron pipe from January 7, 1920.

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
		BUTT WELD			
1/8, 1/4 and 3/8	47%	20½%	3/8 to 1¼	34½%	18½%
1/2	51%	36½%			
3/4 to 3	54%	41½%			
		LAP WELD			
2	47%	34½%	2	28½%	14½%
2½ to 6	50%	37½%	2½ to 6	30½%	17½%
		BUTT WELD, EXTRA STRONG PLAIN ENDS			
1/8, 1/4 and 3/8	43%	25½%	3/8 to 1/2	34½%	19½%
1/2	48%	35½%			
3/4 to 1¼	52%	39½%			
		LAP WELD, EXTRA STRONG PLAIN ENDS			
2	45%	33½%	2	29½%	16½%
2½ to 4	48%	36½%	2½ to 4	31½%	19½%
4½ to 6	47%	35½%	4½ to 6	30½%	18½%

Stock discounts in cities named are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
⅛ to 3 in. steel butt welded	40%	24%	40%	31%	54@40%	40½@30 %
2½ to 6 in. steel lap welded	35%	20%	42%	27%	50@40%	37½@27½%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 32%. Cast iron, standard sizes, net.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	Month Ago	Year Ago
Copper, electrolytic	18@19	19.00	19.00
Tin in 5-ton lots	48.00	51.00	70.50
Lead	8.00	9.00	5.40
Spelter	7.75	8.85	7.45
ST. LOUIS			
Lead	7.75	8.50	5.10
Spelter	7.50	8.37½	7.10

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

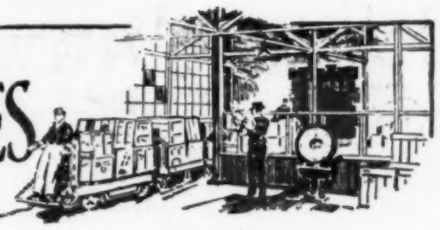
	New York Current	New York Month Ago	New York Year Ago	Cleveland Current	Cleveland Year Ago	Chicago April 8 Current	Chicago April 8 Year Ago
Copper sheets, base	33.50	29.50	27.50	32.00	28@30	36.00	27.00
Copper wire (carload lots)	31.25	31.25	24.00	29.50	26.50	27.00	23.00
Brass sheets	28.50	27.50	23.00	29.00	30.00	27.00	21.50
Brass pipe	33.00	32.00	34.00	34.00	41.00	35.00	31.00
Solder (half and half) (case lots)	33.00	39.00	45.00	40.50	41.25	38.00	39.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	23.75	20.00
New York	25.00	21.50
Cleveland	27.00	26.00
Chicago	26.00	24.00

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:
Carload lots f.o.b. mill..... 12.00

	In Casks		Broken Lots	
	Current	One Year Ago	Current	One Year Ago
Cleveland	15.00	12.95	15.50	13.30
New York	14.00	12.00	14.50	13.00
Chicago	15.00	16.50	15.00	16.00

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	7.50@7.75	8.37½
Chicago	9.50	10.00

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
Copper, heavy, and crucible	16.00	16.00	16.50	16.50
Copper, heavy, and wire	15.25	15.00	16.50	15.00
Copper, light, and bottoms	13.75	13.00	15.00	14.00
Lead, heavy	7.00	4.62½	7.00	7.00
Lead, tea	5.00	3.75	5.00	6.00
Brass, heavy	10.25	9.50	12.50	16.50
Brass, light	7.50	7.75	10.00	9.50
No. 1 yellow brass turnings	8.50	8.50	10.00	10.00
Zinc	5.25	4.25	5.00	5.50

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00	34.00c.@35.00c.	33.50

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	38.00	25.00
Chicago	29.00	28.00
Cleveland	32.00	28.50

BABBITT METAL—Warehouse price per pound:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Best grade	90.00	87.00	74.50	79.00	60.00	75.00
Commercial	50.00	42.00	21.50	17.50	15.00	15.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	New York		Cleveland		Chicago	
	Current	One Year Ago	Current	One Year Ago	Current	One Year Ago
Hot pressed square	+$4.00	1.28	$ .75	$1.90	$.50	2.00
Hot pressed hexagon	+ 4.00	.85	.75	1.90	.50	2.00
Cold punched hexagon	+ 4.00	1.00	.75	1.90	.50	1.30
Cold punched square	+ 4.00	1.00	.75	1.90	.50	1.30

Semi-finished nuts, ⅜ and smaller, sell at the following discounts from list price:

	Current	One Year Ago
New York	30%	50-10%
Chicago	50%	50%
Cleveland	50%	60-10-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	List	20%	20%
Larger and longer up to 1½ in. by 30 in.	+20%	20%	10%

WASHERS—From warehouses at the places named the following amount is deducted from list price:
For wrought-iron washers:
New York..... list Cleveland..... $3.00 Chicago..... $3.00
For cast-iron washers, ½ and larger, the base price per 100 lb. is as follows:
New York..... $7.00 Cleveland..... $4.50 Chicago..... $4.75

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	10%	15%	10%
Larger and longer up to 1 in. by 30 in.	10%	10%	5%

COPPER RIVETS AND BURS sell at the following rate from warehouse:

	Rivets		Burs	
	Current	One Year Ago	Current	One Year Ago
Cleveland	20%	20%	10%	10%
Chicago	net	10%	net	10%
New York	25%	40%	net	20%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ⅞ and smaller	30%	30%	30%
Tinned	30%	30%	30%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:
New York..... $6.00 Chicago..... $5.62 Pittsburgh..... $4.72
Structural, same sizes:
New York..... $7.10 Chicago..... $5.72 Pittsburgh..... $4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	34.00	34.00	35.00
Brass	33.00	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb. advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb. 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ½-2 in. inclusive in rounds, and ½-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

LONG TERNE PLATE—In Chicago No. 28 primes from stock sell, nominally, for $12.50 per 100 lbs.

COTTON WASTE—The following prices are in cents per pound:

	New York			
	Current	One Year Ago	Cleveland	Chicago
White	11.00@15.50	13.00	16.00	11.00 to 14.00
Colored mixed	7.00@10.50	9.00-12.00	12.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	55.00	65.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.00	$3.00	$1.75
Philadelphia	2.75	2.75	1.75
Cleveland	2.50	2.50	2.75
Chicago	2.25	2.25	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	urrent	One Month Ago	One Year Ago
New York	$3.90	$4.00	$3.65
Philadelphia	3.65		
Chicago	5.00	5.00	4.12½

COKE—The following are prices per net ton at ovens, Connellsville:

	July 1	June 24	June 17
Prompt furnace	$17.50@$18.50	$15.00@$16.00	$14.50@$15.50
Prompt foundry	18.00@ 19.00	16.00@ 17.00	15.50@ 16.50

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	100-lb. bag	1.00

LINSEED OIL—These prices are per gallon:

	New York		Chicago	
	Current	One Year Ago	Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.63	$1.90	$2.02	$2.10
5-gal. cans (without cans)	1.66*	2.03	2.27	2.30

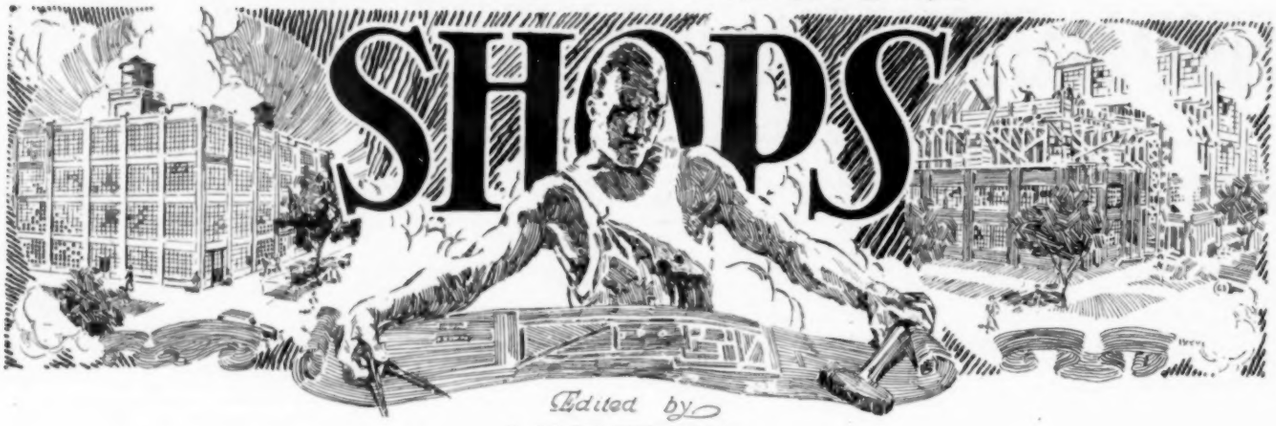
*To this *oil* price must be added the cost of the cans (returnable), which is $2.25 for a case of six.

WHITE AND RED LEAD—Base price per pound:

	Red				White	
	Current		One Year Ago		Current	One Year Ago
	Dry	In Oil	Dry	In Oil	Dry and In Oil	Dry and In Oil
100 lb. keg	15.50	17.00	13.00	14.50	15.50	13.00
25 and 50-lb. kegs	15.75	17.25	13.25	14.75	15.75	13.25
12½-lb. keg	16.00	17.50	13.50	15.00	16.00	13.50
5-lb. cans	18.50	20.00	15.00	16.50	18.50	15.00
1-lb. cans	20.50	22.00	16.00	17.50	20.50	16.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

NEW and ENLARGED



Edited by
L·V·FLETCHER

Machine Tools

The following concerns are in the market for machine tools:

Mass., Chelsea—M. Rosenthal, 64 Hawthorne St.—repair shop equiment.

D. C., Washington—The Bureau of Supplies and Accounts, Navy Dept.—one 14 in. quick change lathe with 8 ft. bed, electric drive.

D. C., Washington—A. L. Flint, Purch. Agt. for the Panama Canal, Washington, D. C., will receive bids until July 15, for furnishing the following tools—

Twenty-four 1½ to 3 in. pipe cutting machines, No. 3 Barnes or equal.
Three 6 to 8 in. pipe cutting machines, No. 6 Barnes or equal.
Three 9 to 12 in. pipe cutting machines, No. 7 Barnes or equal.
Miscellaneous drills running from ⅛ to 1½ in.
Fifteen thousand 12 in. hand hacksaw blades, 14 teeth to the inch.

N. J. Harrison—The Hyatt Roller Bearing Co., Middlesex St.—machine tools for experimental laboratory.

N. Y., Binghamton — The consolidated Utilities Corp.—drill chucks.

N. Y., Buffalo—The Day Mchy. Co., 66 Exch. St.—one double geared press, 48 in. between uprights, 32 in. front to back, 7 in. stroke.
Two toggle drawing presses, 60 in. between uprights, 48 in. front to back, 8 in. depth draw.
One straight sided geared press, 20 in. between uprights, 7 in. stroke, 8 in. die space.
Three open back inclinable geared prsses, 3 in. stroke.

N. Y., New York (Borough of Brooklyn)—The B. & B. Mfg. Co., 100 Everson Pl.—heavy shears to cut boiler plate.

N. Y., New York (Borough of Brooklyn)—E. W. Bliss & Co., Plymouth and Adams Sts.—radial drills and large lathes.

N. Y., New York (Borough of Brooklyn)—The W. H. Jackson Co., 335 Carroll St.—one power punch press with 2 in. stroke and throat as deep as possible; also a 30, 33 and 36 in. woodworker's bandsaw with metal table.

N. Y., New York (Borough of Manhattan)—The Arden Bennett Corp., 450 East 148th St.—one No. 20 Bliss power press, geared.

N. Y., New York (Borough of Manhattan)—W. F. Davis Co., 85 Liberty St.—
One 36 in. geared shaper, Fellows.
One 62 in. vertical boring and turning mill with thread cutting attachment.
One 6 ft. American plain radial drill.
One 36 to 48 in. open side planer, 2 or 3 heads.
Burdick bolt headers, all sizes.
Landis bolt cutters, all sizes.
One 4 ft. Fosdick radial drill, gear box, single pulley drive.
One ¾ in. National wedge grip bolt header.
Heald cylinder grinders, No. 60.
Bullard New Era type vertical boring mills, 36 to 42 in.
One 26 or 28 in. crank shaper.
One No. 68N Bliss double action press.
Squaring shears, 8 and 10 ft., capacity 14 ga.
Pipe machines, 5, 10 and 12 in.
One 48 in. x 18 ga. squaring shear.
Ten-foot rolls for ½ in. plate.
One No. 91C Toledo double crank press.
One solid back stiles pattern press, Ferracute No. P2 or P3, of Bliss No. 2½ or 3.
Angular bending rolls, 4 x 4 x ½ or 5 x 5 x ½ in.
One 32 in. shaper.
One 1,500 lb. steam drop hammer.
One 48 in. x 48 in. x 14 ft. heavy duty planer with 4 heads.
One No. 3 Cincinnati vertical miller.
Gridley automatic screw machine, 1¼ in.
One geared head engine lathe with 36 to 40 in. swing and 12 to 14 ft. centers, Lodge & Shipley, or similar.
Shapers, 20 and 24 in.
Bolt headers and upsetters, 1 to 3 in.

N. Y., New York (Borough of Manhattan)—The Greyhound Motor Corp., 5 Columbus Circle—machine tool equipment for Warren, R. I., plant.

N. Y., New York (Borough of Manhattan)—The Janusch Mfg. Co., 496 East 134th St., A. Hager, Purch. Agt.—French moulding machinery, turning lathes, etc.

N. Y., Schenectady—The General Electric Co., River Rd., A. L. Howgate, Purch. Agt. for Rochester, N. Y., plant—
One universal tool and cutter grinder, equivalent of No. 13 Brown & Sharpe.
For Baltimore, Md., plant—
One toggle press, similar to No. 1½ Bliss, page 394 of their catalog.
One No. 21 press, flywheel type, with cam actuated stripper attachment, similar to Bliss No. 20, page 35 of their catalog.
One screw slotter, equivalent of Acme.
Three gear driven nailing machines, Nos. 16-36, equivalent of Morgan Open Back; one of these machines to be equipped with side arm adjustment.
One rotary patent bevel square end circular shear, equivalent of No. 2 Waugh as sold by Berger Bros., Philadelphia.
One power squaring shear, for No. 16 ga. steel, similar to No. 52 Niagara.
One swing saw, equivalent of Towsley 24 in., left hand, without table, 24 in. guard.
One rip saw, equivalent of Greenlee, size 18.
One buzz planer, equivalent of No. 1 American, 16 in., Fig. 802.
One 24 in. surfacer, equivalent of American.
One back knife lathe, 36 in., equivalent of American No. 1½.
One variety saw bench, equivalent of American No. 1.
One 4 spindle sensitive drill press, 12 in. overhand.
Two 11 in. x 5 ft. speed lathes, equivalent of Blount.
One horizontal tapping machine, equivalent of Hubbell 1½ in.
One automatic handle lathe, similar to Defiance.
One chucking and tenoning machine, similar to Defiance.
One slate and marble swing type polishing machine, made by F. R. Patch Mfg Co., Rutland, Vt., similar to their No. 2662.
To be arranged for constant speed motor drive where practical.

Pa., Philadelphia—The Baldwin Locomotive Wks., Broad and Spring Garden Sts.—one 21 in. stationary head drill, motor driven.

Ga., Atlanta—The E. L. Nash Co., 810 Candler Bldg.—one 1 to 4 in. pipe machine, similar or equal to Oster No. 304 A.

Ky., Lexington—The G. F. Vaughan Tobacco Co., Box 351—small drills, grinders and forges.

N. C., Greensboro — W. H. Harriston, Box 130—stove pipe roller, presses for manufacture of flues and gutters; also general sheet metal working equipment (used preferred).

Va., Richmond — The Barnes Safe and Lock Co., 13th and Main Sts.—
One 6 ft. lathe with 12 in. swing.
One 6 ft. lathe with 18 in swing.
One drill press, 18 in. between drill and table.
One 24 in. shaper.
One 3 in. emery stand.

Ill., Chicago—The Ajax Forge Co., 2503 Blue Island Ave.—one guillotine shear, capacity 3 in. round nickel steel (new or used).

Ill., Chicago—The Evers Sauvage Co., 1610 Cortland St.—one turret lathe.

Ill., Chicago—E. Menkin, 662 West Grand Ave.—lathe, drill press and shaper.

Ill., Chicago—The F. H. Parker Co., 38 South Dearborn St.—one 42 in. drill press and one 20 in. vertical drill press.

Ill., Sterling—The Frantz Mfg. Co.—one 10 ft. squaring shear, capacity 10 ga. to ⅜ in. soft steel (new or used).

Mich., Ann Arbor—The Economy Boiler Co.—
Circle and slitting shears, capacity ¼ in.
One 42 in. vertical boring mill with turret and plain swivel head.
One No. 2 or 2½ full Universal milling machine with single pulley and cone drive (No. 2½ preferred).

Mich., Detroit—J. C. Austerberry, 65 Shelby St.—
One Toledo or Bliss trimming press, 48 in. front to back, 28 in. right to left, 18 in. from bed to ram, motor driven.
One 1,000 lb. board drop hammer, Williams, White & Co.
Two 2,500 lb. single or double frame steam hammers, Chambersburg or Erie.
One set of straightening rolls for ¼ to 2½ in. stock.
One No. 6 Bryant internal grinder.
One 16 in. Hendey or Pratt & Whitney tool room lathe.
One Hinkley cold saw, 15 in. "I" beam capacity.
One 24 x 24 x 5 heavy duty planer.

Mich., Detroit—The Bd. of Water Comrs., 232 Jefferson Ave., H. S. Starkey, Secy.—
One milling machine.
One cutter grinder.
One cold saw.
One power hammer.
Benches and small equipment.

Mich., Detroit—The Michigan Motor Specialties Co., 26-40 Duboise St.—general machine tool equipment.

Mich., Detroit—The Natl. Machine Products Co., 1206 Bellevue Ave., W. H. McGregor, Pres.—miscellaneous machine tool equipment including screw machine.

Mich., Detroit — The Wilton Tool Mfg. Co., 163 Grand River Ave.—miscellaneous machine tools.

Mich., Grand Rapids—The Oliver Mchy. Co., Clancy and Coldbrook Aves., W. M. Tuthill, Secy.—machine shop and foundry equipment, including electric cranes.

Mich., Pontiac — The General Motors Truck Co.—milling cutters.

Mich., Ypsilanti—A. E. Sanford, 109 North Summit St.—all sizes of punch presses, one No. 2 and one No. 3 milling machine and one 18 to 24 in. tool lathe.

O., Cincinnati—The Kemper Thomas Co., Park Ave. and Norwood St.—three small or medium power punch presses (used).

O., Cleveland—The K. W. Ignition Co., 27th St. and Chester Ave.—several No. 0 and 00 Brown & Sharpe automatic screw machines (new).

O., Toledo—The Toledo Automotive Products Co., 2240 Smead Ave.—two multiple spindle Gridley automatic screw machines (new).

Wis., Galesville—J. M. Benrud—garage repair equipment.

Wis., Laona—The Biever Motor Co.—repair shop equipment.

Wis., Milwaukee—The F. Achen Co., 155 Oneida St.—one lathe and one drill press.

Wis., Milwaukee — The Amer. Metal Products Co., 671 Kinnickinnic Ave.—lathes, drill presses, millers and grinders.

Wis., Milwaukee—The Atlas Novelty Co., 2808 Lisbon Ave., H. Beerbaum, Purch. Agt.—punch presses.

Wis., Milwaukee—J. Fratmann, 216 Caswell Blk.—one or two 12 x 14 ft. lathes and one large squaring shear.

Wis., Milwaukee — The W. H. Krueger Motor Car Co., 485 Jefferson St.—one small lathe and one drill press.

Wis., Milwaukee—The Natl. Auto Radiator Co., 513 Wells St.—square shear machine, folder and roller.

Wis., Milwaukee—The M. J. Walsh Co., 141 Sycamore St.—
One back geared milling machine, No. 13 Garvin or equivalent, with power feed 22 to 28 in. from table.
One 8 in. jointer.
Several open back inclinable presses, not geared, No. 3, 5, 5½ or 6 Consolidated or equivalent.

Mo., Kansas City—The Sunshine Motor Co., 1904 Grand Ave.—equipment for grinding cylinders, lathes for sleeve manufacture, automatic drilling machines, multiple spindle drills, etc.

Mo., St. Louis—The Blackman Hill McKee Machine Co., 1513 North Bway.—one 2 in. triple head bolt cutter, motor driven.

N. D., Fargo — The Advance Rumley Thresher Co.—shapers, lathes, etc., and woodworking machinery.

Machinery

The following concerns are in the market for machinery:

N. J., Irvington—The Atlas Fdry. Co.—magnetic separator, nozzle sand blast tumbling mill, exhaust fan and dust arrester.

N. Y., New York (Borough of Manhattan)—The Robins Conveying Belt Co., Park Row Bldg.—bagging machines for bagging oyster shells in 100 lb. lots.

Ky., Louisville—The Preferred Motor Car Co., F. W. Young, Inter-Saw Bldg., Pres.—machinery for car manufacture.

Ky., Louisville — The Stoll Oil Refining Co., 733 River Rd.—lubricating machinery.

Mich., Detroit — The Arrow Tool and Reamer Co., 332 Artillery Ave., W. K. Sieloff, Secy.—miscellaneous machine equipment for plant expansion.

Mich., Detroit—The Dept. of Purchases and Supplies, Municipal Courts Bldg., G. J. Finn., Comr.—one gasoline power crane for yard of Dept. of Pub. Wks.

Wis., Grand Rapids — The Consolidated Water Power and Paper Co.—one traveling crane.

Wis., Milwaukee—A. F. Bick, 439 Beverly Rd.—one 26 to 30 in. band saw.

Minn., Minneapolis — The Flour State Baking Co., until July 15—$40,000 worth of equipment.

Ont., Tillbury—The Tillbury Brick and Tile Co.—presses, mixers, brick cutters, dryers, etc.

Metal Working

NEW ENGLAND STATES

Conn., Bridgeport — The Cave Welding and Mfg. Co., 303 Center St., has awarded the contract for the construction of a 1 story, 42 x 93 ft. addition to its factory on Center St.

Conn., East Hartford — The A. F. Way Co., 32 Union Pl., Hartford, will soon award the contract for the construction of a 1 story, 50 x 150 ft. factory here for the manufacture of machine tools. Estimated cost, $75,000.

Conn., Hartford — The Pratt & Whitney Mfg. Co., 436 Capitol Ave., will soon award the contract for the construction of a 1 story tool room at its plant.

Conn., Waterbury—M. J. Daly & Sons, 543 Bank St., will soon award the contract for the construction of a 1 story, 110 x 180 ft. addition to its plant for the manufacture of sheet metal, etc. Estimated cost, $80,000.

Conn., Waterbury — The E. J. Manville Machine Co., 574 East Main St., will soon award the contract for the construction of a 2 story, 50 x 200 ft. addition to its plant. Estimated cost, $65,000.

Mass., Boston—The Boston Elevator Ry., 108 Massachusetts Ave., will build a 1 story garage. Estimated cost, $25,000.

Mass., Chelsea—M. Rosenthal, 64 Hawthorne St., will soon award the contract for the construction of a 1 story, 70 x 130 ft. garage on Essex St. Estimated cost, $35,000. S. S. Eisenberg, Exch. Bldg., Archt.

Mass., East Springfield (Springfield P. O.)—The New England Westinghouse Co., 165 Bway., New York City, will soon award the contract for the construction of a 4 story machine shop at its plant. Estimated cost, $225,000. B. H. Prack, Keystone Bldg., Pittsburgh, Pa., Engr.

Mass., Jamaica Plain (Boston P. O.)—The Holtzer Cabot Electric Co. will soon award the contract for the construction of a 1 story, 50 x 80 ft. factory. Estimated cost, $15,000. S. D. Kelley, 46 Cornhill, Boston, Archt.

Mass., Lowell—The Saco Lowell Shops, 77 Franklin St., Boston, has awarded the contract for the construction of a 1 story, 130 x 140 ft. foundry on Walker St., here. Estimated cost, $100,000.

Mass., Watertown — The Aetna Mills, Pleasant St., will soon award the contract for the construction of a 1 story, 45 x 110 ft. garage. Estimated cost, $35,000. C. T. Main, 201 Devonshire St., Boston, Engr.

Mass., Worcester—H. J. Murch, 731 Main St., has awarded the contract for the construction of a 1 and 2 story, 60 x 160 ft. garage and service station on Park Ave. Estimated cost, $150,000. Noted April 1.

R. I., Pawtucket—The Fales & Jenks Machine Co., 320 Dexter St., has awarded the contract for the construction of a 1 story, 25 x 105 ft. and 2 story, 22 x 105 ft. addition to its factory for the manufacture of textile machinery. Estimated cost, $30,000.

MIDDLE ATLANTIC STATES

Md., Baltimore — The Miller Safe Co., Fremont Ave. and Briscoe St., a subsidiary of the York Safe and Lock Co., York, Pa., plans to construct several 1 story buildings on Wilkens Ave., Catherine St. and Millington Lane, to cover a total area of 322 x 725 ft. The first unit, which is to cover 60,000 sq.ft. of floor space, will be one-quarter the size of the final plant, and will cost $350,000. Ultimate cost, $1,000,000. J. A. Dempwolf, c/o the York Safe and Lock Co., York, Pa., Archt.

N. J., Irvington—The Atlas Fdry. Co. is building a 60 x 60 ft. addition to its foundry. Estimated cost, $8,000. W. H. Mantz, Mgr.

N. J., Lakehurst—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., has awarded the contract for the construction of a shop and power house at the naval air station here. Estimated cost, $477,000.

N. Y., Buffalo—The Amer. Car and Fdry. Co., 383 Babcock St., has awarded the contract for the construction of a blacksmith and machine shop.

N. Y., Buffalo — The Eberhardt Steel Products Co., 41 Ferry St., recently increased its capital stock from $25,000 to $1,000,000, and has had plans prepared for the construction of a 1 story, 100 x 200 ft. factory, at 622-628 East Ferry St.

N. Y., Buffalo—The Rome Wire Wks., 214 Clyde St., has had plans prepared for the construction of a 2 story addition to its plant. Estimated cost, $12,000.

N. Y., Elmhurst (Flushing P. O.) — The Factory Constr. Co., 44 Court St., Brooklyn, will build a 1 story, 100 x 200 ft. garage in East Elmhurst. Estimated cost, $100,000. L. Gold, Pres.

N. Y., Falconer—The Jamestown Malleable Products Corp., Jamestown, has purchased a 14 acre site here, and is preparing plans for the construction of a 400 x 400 ft. foundry. O. A. Lenna, Allen St., Jamestown, Pres.

N. Y., New York (Borough of Brooklyn)—The Matona Realty Co., 157 Atlantic Ave., will build a 2 story, 65 x 100 ft. garage on Ross St. and Kent Ave., Estimated cost, $250,000.

N. Y., New York (Borough of Manhattan)—The Crotona Realty Co., 170 Bway., will build a 1 story, 85 x 150 ft. garage on Southern Blvd. and 172nd St. Estimated cost, $50,000. W. Weschler, Pres.

Pa., Erie—The General Electric Co. has awarded the contract for the construction of a 1 and 2 story, 230 x 900 ft. machine shop at its plant. Estimated cost, $1,000,000.

Pa., New Kensington—The General Electric Co., River Rd., Schenectady, N. Y., will soon award the contract for the construction of a 1½ story, 70 x 260 ft. factory, here. Estimated cost, $100,000.

Pa., Pittsburgh—The Highland Automobile Co., 5928 Pennsylvania Ave., has awarded the contract for the construction of a 2 and 3 story tire sales and service building on Liberty and Center Aves. Estimated cost, $400,000.

Pa., Wilkes-Barre—The Wyoming Valley Shops, Ruddle St., are having plans prepared by LeGrand & Hazle, Archts., South Main St., for the construction of a 17 x 56 ft. factory. Estimated cost, $30,000.

SOUTHERN STATES

S. C., Charleston—The Cyclone Starter and Truck Co. has awarded the contract for the construction of a 1 story, 100 x 260 ft. factory and a 1 story, 30 x 44 ft. boiler house. Estimated cost, $200,000.

Va., Quantico—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., will soon award the contract for the construction of a garage and storehouse here, Specification No. 4225.

W. Va., Beechbottom (Wellsburg P. O.)—The Beechbottom Power Co. has awarded the contract for the construction of a 1 and 2 story, 100 x 140 ft. locomotive repair, machine and blacksmith shop. Estimated cost, $80,000.

MIDDLE WEST

Ill., Chicago — The Stewart Warner Speedometer Co., 1828 Diversay Parkway, has awarded the contract for the construction of a 6 story, 96 x 170 ft. factory at 830 Diversay Parkway. Estimated cost, $350,000.

Ill., Elgin—The Elgin Natl. Watch Co. has awarded the contract for the construction of a 3 story, 50 x 118 ft. horological institute on Grove Ave. Estimated cost, $100,000.

Ind., Valparaiso—The McGill Metal Co. will build a plant for the manufacture of bronze die castings, to have 30,000 sq.ft. of floor space. Estimated cost, $100,000.

Mich., Detroit—The Kirby Ave. Development Co., c/o Smith, Hinchman & Grylls, Archts., 710 Washington Arcade, will soon award the contract for the construction of a 3 story, 101 x 155 ft. service station. Noted July 1.

Mich., Detroit—The Standard Reamer and Tool Co., Elmwood Ave., has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory for the manufacture of tools.

Mich., Mt. Pleasant — The Transport Truck Co. plans to build a 90 x 240 ft. factory. J. Ferris, Mt. Pleasant, Engr.

O., Akron—The Whitman & Barnes Mfg. Co., Chicago, manufacturer of twist drills and reamers, has merged with the J. H. Williams Co., Brooklyn, and plans to enlarge its plant here.

O., Canton—The Schlemmer & Graber Co., 12th St., N.E., has awarded the contract for the construction of a 1 and 2 story, 100 x 250 ft. garage and service building. Estimated cost, $95,000.

O., Cleveland—The Amer. Can Co., 1677 East 40th St., is having plans prepared by C. E. Preis, Engr. and Archt., 420 Bway., for the construction of a 6 story, 60 x 170 ft. factory on Payne Ave. and East 41st St. Estimated cost, $200,000. H. C. Meyers, Supt. Noted May 13.

O., Cleveland—The Judd Automobile Co., 4601 Euclid Ave., has awarded the contract for the construction of a 2 story, 120 x 235 ft. garage on East 46th St. and Euclid Ave. Estimated cost, $125,000. A. Henn, Secy.

O., Cleveland—The Lake Erie Steel Co., Stop 13, A.B.C. Line, has awarded the contract for the construction of a 1 story, 50 x 180 ft. addition to its steel mill. Estimated cost, $75,000. J. Palmer, Mgr.

Wis., Milwaukee—The F. Achen Co., 155 Oneida St., will soon award the contract for the construction of a 2 story, 120 x 150 ft. garage and salesroom on Jackson St. Estimated cost, $100,000. Van Ryn & De Gelleke, Caswell Blk., Archts. and Engrs.

Wis., Milwaukee—The Amer. Metal Products Co., 671 Kinnickinnic Ave., had plans prepared for the construction of a 1 story, 80 x 200 ft. machine shop and foundry on Burnham St.

Wis., Milwaukee—The Heil Co., 26th and Montana Aves., manufacturer of structural iron and tanks, has awarded the contract for the construction of a 1 story, 125 x 250 ft. assembling plant on 26th Ave.

Wis., Milwaukee—The W. H. Krueger Motor Car Co., 485 Jefferson St., will soon award the contract for the construction of a 2 story, 40 x 120 ft. garage. Estimated cost, $60,000.

WEST OF THE MISSISSIPPI

Ia., Cedar Rapids—H. T. Hedges has awarded the contract for the construction of a 1 story garage and repair shop. Estimated cost, $50,000.

Minn., South St. Paul—The Bd. Educ. is having plans prepared by Toltz, King & Day, Archts., Pioneer Bldg., St. Paul, for the construction of a 2 story high school, to include a manual training department. Estimated cost, $475,000. J. R. Stevenson, clk.

N. D., Fargo—The Advance Rumley Thresher Co. will soon award the contract for the construction of a 2 story, 125 x 250 ft. factory and office building. Estimated cost, $125,000.

N. D., Hankinson—The Bd. Educ. is having plans prepared for the construction of a 2 story, 65 x 130 ft. high school to include a manual training department. Estimated cost, $135,000. The Terry Schulte Eng. Co., Endicott Bldg., St. Paul, Engrs. Buechner & Orth, Shubert Bldg., St. Paul, Archts.

S. D., De Smet—The Bd. Educ. is having plans prepared by W. L. Alban, Archt., Endicott Bldg., St. Paul, for the construction of a 2 story high school to include a manual training department. Estimated cost, $100,000.

Tex., Dallas—The Samson Tractor Co., Keating Bldg., is having plans prepared for the construction of an assembling plant. Estimated cost, $100,000. L. F. Gorlock, Mgr.

General Manufacturing

NEW ENGLAND STATES

Conn., East Hartford—Olds & Whipple, 166 State St., Hartford, have awarded the contract for the construction of a 1 story, 180 x 220 ft. tobacco plant with 25 x 80 ft. ell. Estimated cost, $150,000.

Mass., Boston—H. K. Mead, 201 Devonshire St., has awarded the contract for altering his 5 story, 80 x 110 ft. factory on Albany St. for the manufacture of felt products. Estimated cost, $12,000.

Mass., New Bedford—The W. C. Jones Co., Nash Rd., has awarded the contract for the construction of a 3 story mill on Church St. for the manufacture of cotton waste. Estimated cost, $75,000. Noted July 1.

Mass., Roxbury—The Cabel Mfg. Co., 77 Northampton St., will build a factory on William St., for the manufacture of rubber specialties. Estimated cost, 25,000.

Mass., Willimansett—The New England Tire and Rubber Co., Springfield, Mass., is preparing plans for the construction of a factory here. F. H. Callahan, Pres.

R. I., Bristol—The Cranston Worsted Co., 180 Thames St., has awarded the contract for the construction of a 4 story, 100 x 130 ft. addition to its plant. Estimated cost, $160,000. Noted July 1.

R. I., Woonsocket — The Glenbrook Worsted Mills has awarded the contract for the construction of a 1 story, 85 x 200 ft. factory and boiler house on Mason St. Estimated cost, $100,000.

Vt., Proctor—The Vermont Marble Co. is building a marble sawing mill.

MIDDLE ATLANTIC STATES

Del., Wilmington—The Wilmington Provision Co., 3rd and Orange Sts., is having preliminary plans prepared by C. B. Comstock, Archt. and Engr., 11 West 40th St., for the construction of alterations and additions to its packing house on Front St. Estimated cost, $100,000.

Md., St. Helena—The Glidden Co., Madison Ave., N.W., Cleveland, O., has acquired the lithophone plant of the Chemical Pigments Corp., here, and plans to increase its capacity. The above company will be operated under the name of the Glidden Co. Lithophone Dept., A. D. Joyce, Pres.

N. J., Asbury Park—The Hill Bakery Co., North Stockton St., Trenton, plans to build a bakery on Main St., here. Estimated cost, $150,000. J. N. Barber, 395 State St., Trenton, Pres.

N. Y., Buffalo—The Donner Union Coke Co., Abbey and Mystic Sts., has had plans prepared for the construction of a 1 story, 18 x 32 x 58 ft. addition to its plant. Estimated cost, $12,000.

N. Y., New York (Borough of Brooklyn)—The Advex Corp., c/o W. Whitehall, Engr. and Archt., 55 Duane St., New York City, is building an addition to its factory on Franklin Ave. and Montgomery St., for the manufacture of pastes and glues. Estimated cost, $40,000.

Pa., Philadelphia—The Bureau of Yards and Docks, Navy Dept., Washington, D. C., will soon award the contract for the construction of a mattress factory at the Navy Yard, here.

Pa., Pittston—The Pittston Silk Throwing Co., 91 North Main St., plans to build a 2 story, 60 x 150 ft. silk mill. Estimated cost, $60,000.

Pa., Tyrone—The Stevenson Laundry Co. will soon award the contract for the construction of a 3 story, 80 x 100 ft. laundry on Bald Eagle Ave. and 12th St. Estimated cost, $100,000.

Pa., Whites Ferry (Falls P. O.)—The Boys' Industrial Home plans to build a 2 story, 100 x 400 ft. dairy. Estimated cost, $100,000.

SOUTHERN STATES

Ky., Henderson—The Lucking Distributing Co., Cincinnati, has purchased the plant of the Peerless Distillery Co., here, and plans to build improvements and install new machinery. Estimated cost, $30,000.

Ky., Lexington—The G. F. Vaughan Tobacco Co., Box 351, will build a 63 x 216 ft. factory. Estimated cost, $15,000. J. J. Settlemayer, Mgr.

N. C., Spindale—The Stonecutter Mills Co has awarded the contract for the construction of a yarn and cotton mill. Noted Feb. 26.

S. C., Greenville—H. Wilkins and others plan to build a factory for the manufacture of folding ladders. Cost to exceed $50,000.

Tenn., Kingsport—The Grant Leather Corp. is building a 2 story, 275 x 500 ft. factory. Estimated cost, $300,000.

Va., Richmond—The Amer. Lace Leather Co., Virginia St. between 13th and 14th Sts., is having plans prepared by Carneal & Johnson, Archts., Chamber of Commerce Bldg., for the construction of an addition to its plant.

W. Va., Warwood (Wheeling P. O.)—The Wheeling Cement Products and Building Co., 622 Wheeling Bank and Trust Co. Bldg., Wheeling, is building a factory here, for the manufacture of building tile.

MIDDLE WEST

O., Cleveland—The Standard Envelope Mfg. Co., 1011 Oregon Ave., plans to build a 2 story factory. Estimated cost, $75,000.

O., Cleveland—D. D. Wessels, 1386 East 17th St., is having plans prepared for the construction of a 2 story, 100 x 110 ft. factory on East 21st St. and Oregon Ave., for the manufacture of concrete tubs. Estimated cost, $100,000.

O., Ravenna—The Cleveland Worsted Mills Co., 6140 B'way., has awarded the contract for the construction of a 4 story, 50 x 150 ft. addition to its plant. Estimated cost, $100,000. G. W. Hodgson, Mgr.

Wis., Milwaukee—The Amer. Candy Co., 215 Bway., has awarded the contract for remodeling its factory. Estimated cost, $15,000.

WEST OF THE MISSISSIPPI

Ia., Muscatine—The Muscatine Packing Co. has awarded the contract for the construction of a packing plant to consist of a 5 story, 50 x 100 ft. factory, 5 story, 100 x 200 ft. cold storage building, 5 story, 70 x 85 ft. abattoir, etc. Estimated cost, $1,000,000.

Ia., Sioux City—The Sioux City Casket Co. will soon award the contract for the construction of a 3 story, 44 x 190 ft. factory and office building. Estimated cost, $200,000. Beuttler & Arnold, Sioux City, Archts.

Minn., Minneapolis—The Flour State Baking Co. is building a 4 story, 60 x 150 ft. bakery on 36th St. Estimated cost, $200,000.

Mo., St. Louis—The Blanton Oleomargerine Co., 1st and Spruce Sts., has awarded the contract for the construction of a 5 story, 72 x 151 ft. factory and power plant. Estimated cost, $300,000.

WESTERN STATES

Wyo., Shoshoni—The Wyoming Chemical Products Co., Duluth, Minn., plans to build a 1 story plant here, for the manufacture of alum and epsom salts, to consist of one 30 x 60 ft., three 40 x 100 ft. and two 40 x 120 ft. buildings. Estimated cost, including equipment, $200,000. W. G. Wey, Shoshoni, Engr.

CANADA

Ont., Kenora—The St. Francis Pulp and Paper Co., Winnipeg, will soon award the contract for the construction of a paper mill on the banks of the English River, north of here. Estimated cost, $500,000.

Ont., Toronto—The Sunlight Soap Co., Eastern Ave., plans to build a 3 story factory. Estimated cost, $350,000.

Que., Montreal—The Natl. Drug Co., St. Lawrence St., will soon award the contract for the construction of a plant in the St. Henry District. Estimated cost, $175,000.

NEED COMPETENT MEN?
SEE THE SEARCHLIGHT SECTION
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